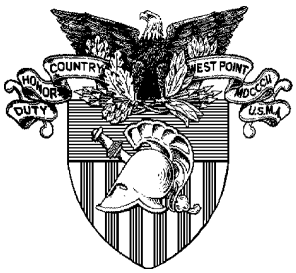

United States Military Academy

West Point, New York 10996

Effects Based Assessment Support System (EBASS)

OPERATIONS RESEARCH CENTER OF EXCELLENCE
TECHNICAL REPORT DSE-TR-0539
DTIC #: ADA448132

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Abstract

The Effects Based Assessment Support System (EBASS) is a distributed operational assessment tool based on the principles of Value Focused Thinking (VFT) developed jointly by the Operations Research Center of Excellence (ORCEN) and the Information Technology and Operations Center (ITOC) at the US Military Academy. Its genesis is work done in support of the military command in Afghanistan in 2002. Effects based assessment is utilized to determine the progress of organization to influence behaviors or the environment to achieve a specific end state. In order to facilitate this, decision makers need a data collection and information visualization tool flexible enough to utilize measures most appropriate for the domain, which 1) provides a qualitative value model which can account for the decision makers' most important evaluation considerations & measures, and 2) provides quantitative scoring functions and weights to evaluate alternatives.

About the Author(s)

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The authors wish to thank the tams which developed the Dynamic Planning and Assessment Support System (D-PASS) and Afghanistan National Development Assessment System (ANDAS) models for setting the stage for this work. Additional thanks goes to Dr Gregory Parnell and COL(R) William Klimack for there insights into valued focused thinking.

A final thanks goes to the staff members and major commanders who provided their time and energies to help develop EBASS and proved its usefulness through use in real-world operations and training events in support of the Global War on Terrorism (GWOT). Their daily dedication and steadfast efforts help to protect our way of life.

Our mention of these contributors does not imply their approval of our results. The opinions contained herein are the opinions of the authors and do not necessarily reflect those of JFCOM, the United States Military Academy, the United States Army, or the Department of Defense.

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Chapter 1: Introduction

Today, we lack metrics to know if we are winning or losing the global war on terror. Are we capturing, killing or deterring and dissuading more terrorists every day than the madrassas and the radical clerics are recruiting, training and deploying against us?

-- The Honorable Donald Rumsfeld

("Rumsfeld's war-on-terror memo", USA Today, Oct 22, 2003)

The above statement by the US Secretary of Defense is as significant as it is obvious. It is significant because we as a nation and as a military require substantiated assessments to determine future courses of action and to eventually leave behind a safe, secure and stable Afghanistan and Iraq. Just as most businesses rely exclusively on metrics to assess their productivity and chart future actions to achieve their goals, we should require nothing less from our military and government. In application however, finding the right metrics and leveraging them to help make better decisions tend to be more easily said than done.

The difficulty arises from the consideration of multiple factors including the dispersion of forces, a more complete understanding of enemy intensions and capabilities, the complexities associated with military and political goals and objectives, and, we believe, a clear and robust methodology to support such an assessment to ensure the organization is obtaining the desired effects.

In this paper, we submit a methodology based on sound operations research theory and an application to improve the military and government's capabilities to link metrics to the objectives they are trying to achieve. This methodology found its genesis in Afghanistan, was developed in laboratory environments and tested in Iraq and other Operational and Strategic headquarters throughout the world. Though this application and methodology is still maturing, it is doing so under fire and is becoming a force in the assessment community. Our application and

methodology, now known as the Effects Based Assessment Support System (EBASS), has been jointly developed by the Operations Research Center of Excellence (ORCEN) and the Information and Technology Operations Center (ITOC), both at the United States Military Academy at West Point.

EBASS is a unique application of Value Focused Thinking (Keeney, 1992) and the integration with a web-based application to facilitate distributed inputs and analysis. EBASS is also beginning to have a significant impact on the Global War on Terror (GWOT). In short, EBASS is:

- Web-based application designed to *automate* and *document* the *management of data* associated with effects, measures of effectiveness, and associated indicators;
- Specifically geared toward *action officers* on Regional Combatant Command (RCC)/Joint Task Force (JTF) staffs;
- Developed by the United States Military Academy (USMA) Information Technology and Operations Center (ITOC) and the Operations Research Center (ORCEN); and
- Initial development in Afghanistan in support of Operation Enduring Freedom (OEF).

Although EBASS is a tool that assists in the assessment of effects based operations, it is ***NOT***:

- A magic formula for assessment;
- A replacement for effects-based planning;
- A replacement for assessment process;
- Part of the operational network assessment (ONA); or
- A briefing tool for senior leaders.

We begin this paper by explaining the genesis and development of EBASS. We continue with a description of the model approach and describe the details of the web-based application. We then address how EBASS helps a headquarters directly address or overcome many of the difficulties encountered when developing assessment methodologies. We conclude with a summary of the applications of the system to date and the future of the system.

Chapter 2: Background

2.1 Dynamic Planning and Assessment Support System

In early June 2002, the Director of the Staff of the Combined and Joint Task Force-180, stationed in Bagram, Afghanistan made a request to the US Military Academy (USMA) for five officers to fill critical positions on the Coalition Joint Task Force (CJTF) Planning Staff, CJ-5. The Academy responded quickly to this request and within a week an officer from five different academic departments was identified and had begun the deployment process. The specific mission given to these officers was not specified until the group arrived in Afghanistan in mid June. That mission, the development of a comprehensive and distributed process for performing operational assessments, became the focus not only for these five officers but for ten faculty members from the USMA Department of Electrical Engineering and Computer Science and the Information and Technology Operations Center. This squad of additional faculty members, both military and civilian, made significant contributions to the design and implementation of the fully distributed web-based application that came to be known as Dynamic Planning and Assessment Support System (D-PASS).

The CJTF staff, and in particular, Lieutenant Colonel James Dickens, the Deputy Director of Plans, CJTF-180, specified a number of important requirements for the system to the D-PASS development team. These were requirements they felt were not met by their existing non-automated process. In addition, they did not feel that their requirements were met by other existing software systems, including the CENTCOM-developed Campaign Analysis/Decision Support System (CA/DSS) (Carlock, 2002). It should be noted that while the CA/DSS did not meet the needs of the CJTF-180 staff many of the underlying ideas in D-PASS, particularly the

employment of a hierarchical arrangement of effects, objectives, and tasks, were inspired by the CA/DSS application.

The stated requirement for D-PASS was that it "provide an automated means to develop and refine effects-based strategic, operational, and tactical assessments to support the planning process." (Dickens, 2003) In more detail, the CJTF-180 staff requested that the D-PASS team design and implement an application that supported an assessment process for the CJTF staff that was rigorous, consistent, and well-coordinated. Significant effort was expended on the part of D-PASS developers in Afghanistan and at West Point to ensure that the resulting application met these requirements.

Two early design decisions proved to be critical to the success of the project. These decisions included using an uncomplicated web interface and incorporating the use of a relational database. Because the application uses a relational database, the many important relationships between various areas of assessment could be readily represented and captured. This database "back-end" also allowed staff officers to provide greater justification for their assessments for other users of the system, particularly the Commander. The distributed nature of the application was fully facilitated through the use of a simple web-interface. This allowed CJTF staff officers who were responsible for assessment to directly collaborate with their counterparts in other staff sections on the CJTF staff as they performed their respective assessment. If should be noted that prior to the development of D-PASS, operation assessments performed by CJTF staff officers were done using ad-hoc methods that provided only limited justification for assessment to the CJTF-180 Commander and higher headquarters.

Another benefit of D-PASS was that, in addition to serving as an analysis tool, its uncomplicated, graphical web interface allowed it to serve as an excellent presentation tool. For

nearly eighteen months the CJTF Commander received weekly or bi-weekly briefings in which D-PASS was the primary presentation medium. This meant that very little time was devoted by staff officers translating information from D-PASS to a presentation graphics application (i.e., Microsoft PowerPoint).

The D-PASS team was able to successfully address many challenges during the development process including: the need to develop and test an unclassified application that processes primarily classified data, and the 12-hour time difference between Afghanistan and New York. One challenge that proved intractable to the team was the inability of the team to incorporate quantitative analysis into the assessment process. There are clearly areas where such analysis would contribute to a better overall assessment but, unfortunately, the D-PASS team was unable to develop consensus among the users of the system concerning the manner in which this analysis should be done. Consequently, the final prototype for D-PASS, while considered an unqualified success by all of it initial users, provided almost no support for quantitative analysis.

2.2 Afghanistan National Development Assessment System

When a new group assumed command of the forces in Afghanistan, they initially used D-PASS as their primary assessments means. On an assigned day each week, the Assessment Working Group would meet to discuss one or more of the Operational Objectives the command was training to achieve. Later that week, the Assessments Officer would present their results to the Effects Targeting Group, usually attended by the Director of the CJFT Staff, BG Byron Bagby or by the Commanding General, LTG John Vines. Each week, the presiding general officer questioned the assessments and would demand to know what metrics the Assessment Working Group was using to come to their conclusions.

By mid-July 2003 it had become clear to CJTF-180 that D-PASS alone was not providing them with the assessment means they desired. Mounting frustrations by the command group, as well as the Assessment Working Group, prompted the command to contact the ORCEN at the US Military Academy to assist in the development of a different assessment methodology.

After discussions with the staff and BG Bagby and analyzing the current hierarchical, task-based structure in D-PASS, the team concluded that quantitatively measuring the accomplishment of tasks did not directly relate to the achievement of effects, or objectives as they are sometimes called (JFCOM, 2005.) By assessing task accomplishment, the D-PASS system was essentially measuring whether an organization is "doing things right." Effects assessment, on the other hand, requires measuring whether an organization is "doing the right thing." The new command wanted to shift to the latter – and link their assessment to metrics.

To measure whether CJTF-180 was doing the right things, the team knew they could not just measure the top level effects. They were too complex and comprehensive to glean enough insight from a few metrics, no matter how ingeniously divined. The top-level effects had to be decomposed into sub-effects and continued in this manner until they could be directly measured.

In the development of this effects hierarchy, the team worked with members of the CJTF-180 staff to develop the important sub-objectives and measures of effectiveness. The development was accomplished through a group effort between the analysts and the staff. It is significant to include the staff in this development for their insights. Their involvement also aids in "buy-in" which is critical to long term usage of the system. Together they built a very comprehensive hierarchy of effects, sub-effects and objectives and MOEs to assess the overall operation in Afghanistan.

The development of this hierarchy was only the beginning. The most difficult and important step was converting this hierarchy to an assessment methodology. To do this, the team turned to "value modeling" (Keeney, 1992). Value modeling, which is part of an approach known as Value Focused Thinking, is generally used to analyze between competing alternatives and is a common approach in decision analysis (See Parnell, 2003).

This value modeling, which we explain in greater detail in this paper allowed the team to develop an assessment system that directly linked metrics with effects the command wanted to achieve. This hierarchy and the overall value model the staff and the team developed became known as the Afghanistan National Development Assessment System (ANDAS) and was integrated into an Excel-based tool.

Between arrival of the second support team in Afghanistan and final ANDAS model development, a new commander arrived, LTG David Barno and the team was excited to brief to him their work. Unfortunately, LTG Barno did not like the model and did not trust the numbers the model produced. He had many just criticisms of the model and the analytical approach. Though ANDAS failed to garner further support, an arguably better system advanced as a result--the Effects Based Assessment Support System (EBASS).

2.3 Effects Based Assessment Support System (EBASS)

The team left Afghanistan disappointed by not discouraged by the ANDAS reception. They knew the approach was solid yet unrefined. The most obvious refinement was to address the limitations of using Excel for the application. Excel did not allow distributed inputs and viewing, both of which were key benefits of D-PASS.

Upon the return of the second Afghanistan team, the ORCEN and the ITOC at West Point began to integrate the analytical approach of ANDAS and the distributed functionality of D-

PASS. The resulting system (Figure 1) became known as the Effects Based Assessment Support System (EBASS). Since its development, EBASS has been integrated into major US military commands from Hawaii to Iraq. The system addresses many concerns of commanders and staffs have in conducting assessments and it is the focus of the remainder of this paper. We begin with a more detailed description of the analytical approach and follow the web-based functionality afforded by the system. We finish with our directions.

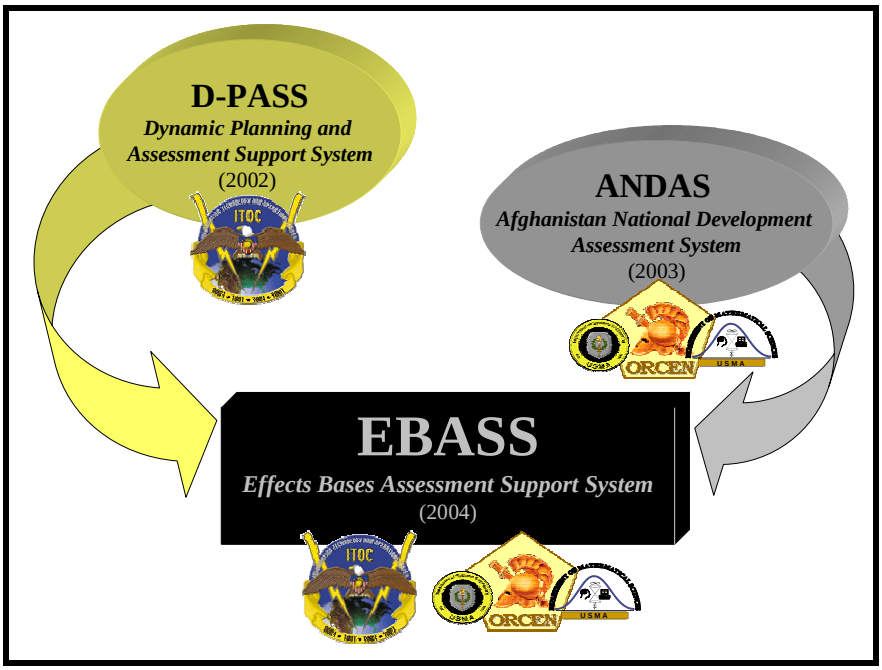

Figure 1. Origins of EBASS

2.4 Value Approach to Effects Based Operations Assessment

Value Focused Thinking is a means to assess the "value" of a variety of alternatives through the development of significant metrics. It requires the development of a hierarchy which is developed through interactions with the decision maker and other actors in the system. The first step is to identify the primary goal of the problem being addressed. The goal is then decomposed into sub-functions and eventually objectives which can be directly measured. A depiction of this hierarchy is at Figure 2, below.

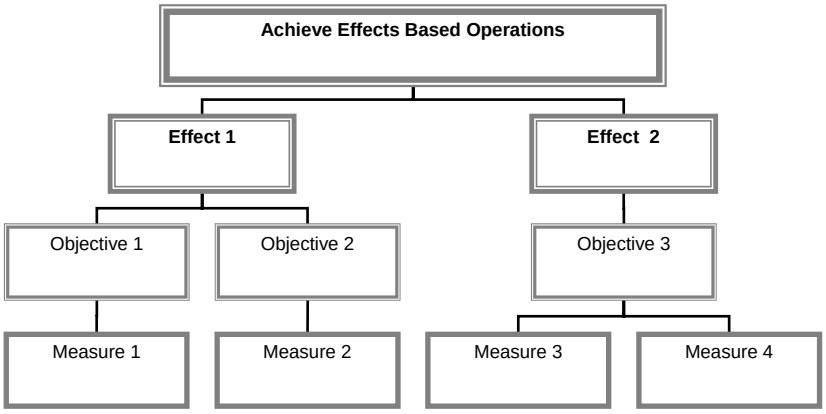

Figure 2. Effects Based Hierarchy Example[1]

The metric is the "mapped" to a value score through the application of a value curve. In this approach, the analyst develops, in conjunction with a client, a "value curve". This curve is intended to be the functional transformation of the measure of effectiveness to a value between 0 and 1. The shape of these curves is important and must be decided on based on the relative level of importance (or client value) of increasing the level of the measure.

The four basic examples of the shapes of the curves are shown in Figure 3 below. Note in this example, all types of curves are shown on one chart. The analyst would develop a chart for each measure and use the curve type (and parameters) to develop the appropriate transformation function.

[1] Parnell, Gregory A., "Introduction to Decision Analysis using Value Focused Thinking," presentation as part of course given through Innovative Decisions, Inc., 2003, slide 8.

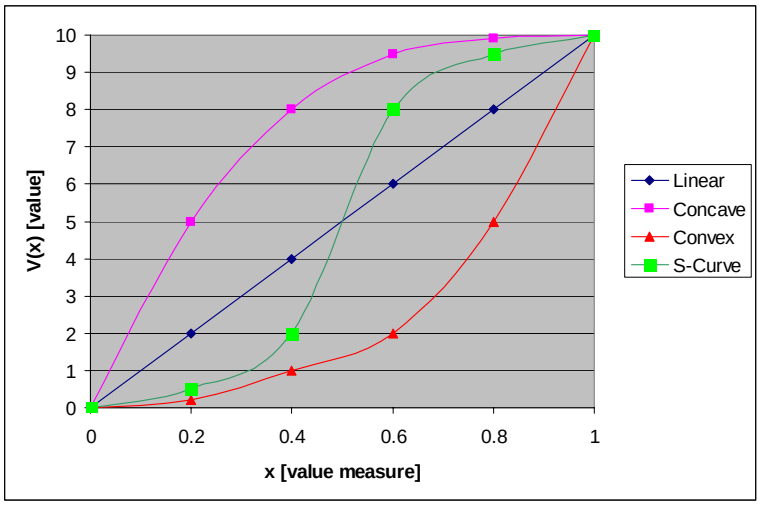

Figure 3. Four types of value functions[2]

Though continuous functions for the value curves are preferred, the "curves" can also take the form of discrete events. Examples are the development of a constitution for a country, as was done in Afghanistan. In this instance, the discrete events could be No draft constitution, constitutional convention begins, a draft constitution is formed, draft approved, the constitution is approved by the population. In this example, the value transformation may take the form shown in Figure 4, below.

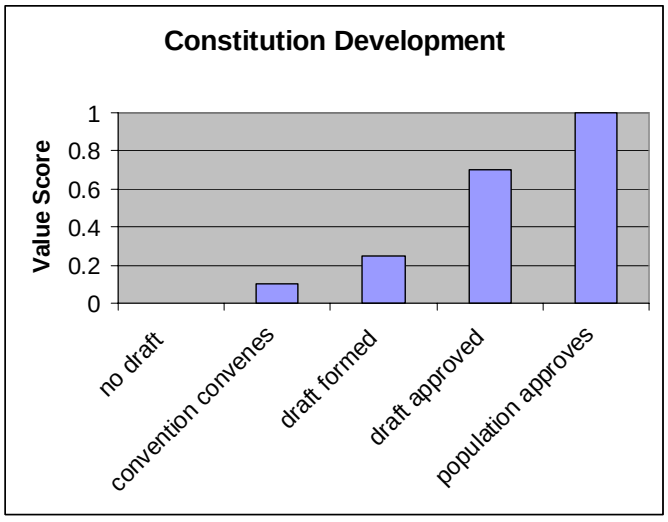

Figure 4. Discrete Value Transformation Curve[3]

[2] Parnell, Gregory, "Value Focused Thinking", Chapter 20 in *Methods for Conducting Military Operational Analysis: Best Practices in Use Throughout the Department of Defense* Accepted by Editorial Staff, June 2004.

After the development of the hierarchy including the measures and establishment of the value functions, the decision maker identifies (or the staff suggests) weights for each function, sub-function and eventually each measure. The weights for each measure, which sum to one for each level, are then multiplied by the value of that measure which results in a "score" at each level. In the application of this approach to assessment systems, the weights represent the commander's priorities for the varying effects the command would like to achieve.

To determine the value at each parent node in the system, the weights and values are multiplied together and then summed as shown in equation 1, below. Here the total value of a given node *j* is given as $V(X_j)$ where λ_i is the weight at node *i* and $v_i(x_{ji})$ is the value for all *n* metrics which are "children" of the parent node *j*.

$$V(X_j) = \sum_{i=1}^{n} \lambda_i \cdot v_i(x_{ji}) \qquad \text{Equation } 1^4$$

When applied to an assessment system, these values in and of themselves do not have meaning. It is only when taken over a period of time when the trends can be analyzed for meaning. In this way, the decision maker (and/or the staff) can use the trends to identify methods which are being successful and which are not. They can also use this information to help identify the overall effect of a course of action. This is accomplished by estimating the potential impact of a given course of action on each of the metrics. The new score at each parent node will provide the insight to determine if the course of action will have a net positive effect or a net negative effect. To illustrate this, the following simple example is used.

Assume that a unit is engaged in a counter-insurgency mission and there are only two main effects they are trying to achieve. One is to provide security and the other is to win the

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[3] Kwinn, M., E. Pohl, R., Deckro, G, Kostas, "Afghanistan National Development Assessment System", model developed to assess progress in Afghanistan for CJTF-180 during Operation Enduring Freedom, October 2003.
[4] Kwinn, et al, April 2004, slide 8.

hearts and minds of the populace. To counter illegal activity, someone suggests imposing a curfew and conducting nighttime roving patrols. This will have the effect of reducing the nocturnal illegal activities but may also create some animosity towards the security forces from the general populace. By determining where on the value curves the metrics for illegal activity and acceptance are and the estimated changes will be, the staff can make a recommendation as to the overall effect of applying this course of action. We now turn to our application to effects assessment.

2.5 Final Model Development

The team initially felt that there was sufficient functionality incorporated in the original D-PASS programming to integrate the weighted sum and trend analysis of the new system. As development progressed however, it soon became clear that changing the original code would be as problematic as a complete construction of a new system.

This new system is a fully distributed, web-based replication of the functionality of the Excel-based system. It offers trend analysis, the capability to provide subjective assessments by subordinate sections and commanders at all levels and a means to change the functions, sub-functions and measures without reprogramming the entire system. Figure 5 is a screen shot of the developmental opening page of the system.

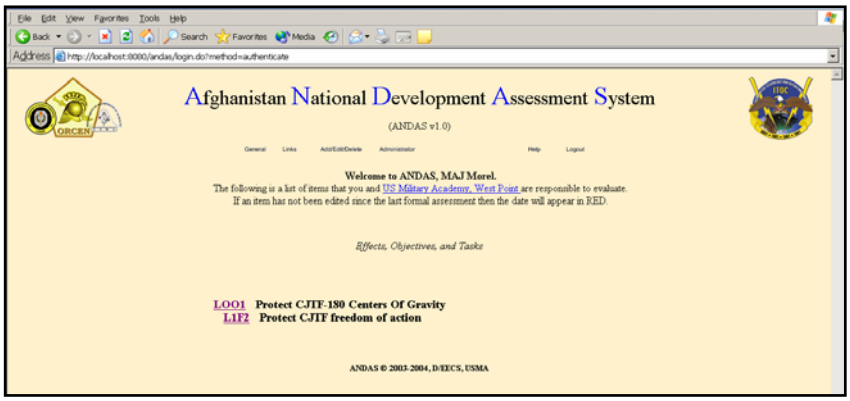

Figure 5. Opening Page of the Web-based ANDAS

The ease of viewing of the status of the trend of the sub-functions is seen in Figure 6. In this screen shot, one sees a notional Line of Operation (LOO) and the trend for this LOO. Note the inclusion of the subjective assessments below the LOO description and the decomposition of the LOO on the right side of the screen.

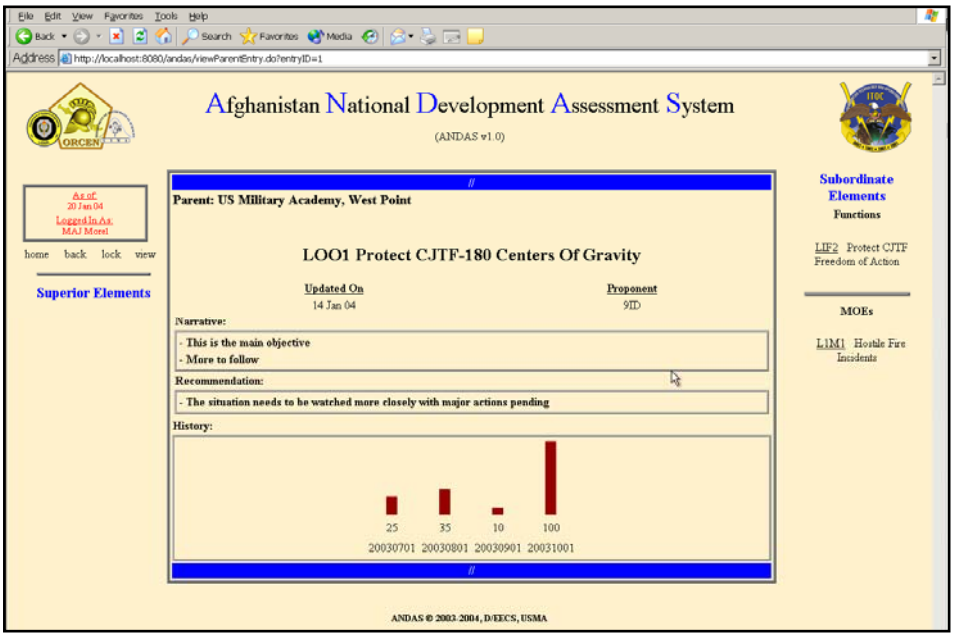

Figure 6. Notional Line of Operation Assessment

The measures under the higher level functions and LOOs are listed on the right hand side of the screen. The user can enter at any level and see the trend of the function, the LOO or the measure over time. This will allow the analyst to determine which effects they should recommend the command focus their efforts in future operations.

The measures will be input by each responsible staff section on their own web page. The sections will sign into the system and can view the status of all the functions, but can only modify the value of the measures associated with their sections. Only the administrator, usually the Assessment Team Chief, will be allowed to modify the weights, the functions or sub-functions, and the actual measures. This will help prevent sections from modifying the weights to change the trend results.

Chapter 3: Effects Assessment

Assessment has been a significant part of most military operations. It is directly addressed in most military doctrine. For example, the Air Force has its OODA loop (Observe, Orient, Detect, and Assess) (Baner, 1999). This loop defines the process Air Force pilots targeting methodology. The Army works hard to improve the reliability and timeliness of Battle Damage Assessment (BDA) to ensure the effectiveness of their operations to improve future operations (Koffinke and Brown, 1993). Assessments continue to play a huge role in military operations in United States' Global War on Terror (GWOT), especially operations in Afghanistan (Operation Enduring Freedom (OEF)) and in Iraq (Operation Iraqi Freedom (OIF)).

Assessments are very difficult in these types of operations and are increasingly difficult the higher the headquarters performing the assessments. Most of the difficulties stem from the recent focus on "Effects Based Operations (EBO)" vice more "task based" operations which characterized actions – and assessments – in previous conflicts (Fayette, 2001).

Based on our experience gained from discussing effects assessment with high-level operational and strategic staffs, senior leaders and great thinkers, much of the rationale for not directly tying metrics to effects assessment can be placed into three broad categories: the multiple interactions between tasks and effects, inability to analytically describe the relationship between effects and sub-effects, and the lack of trust placed in quantitative results.

3.1 Task-Effect Interactions

In World War II, we knew that to defeat Germany: we had to get to Berlin. How did we know we were achieving success? How close were we to Berlin! In a linear battlefield with well defined objectives, the tasks required for success – and assessment – become much clearer. The current military environment is much different. In the operations in Iraq and Afghanistan, the

coalition forces are trying to achieve difficult-to-define objectives. One such objective could be creating stability in a country. These objectives are often sub-defined into effects and achieving these effects has become known as Effects Based Operations (EBO). Often these effects have tremendous interactions which lead to conflicts between achievement of different effects and objectives stemming from military operations (Davis, 2001). An illustrative example helps explain this difficulty.

Assume that there are two effects a military headquarters would like to achieve: "Create a safe and secure environment" and "Achieve acceptance of the local populace". In order to achieve the first effect, a commander might direct that street patrols be conducted in a city area. This clearly would create a more safe and secure environment in the area the patrols cover. The populace however would not appreciate the increased military presence and intrusion on their freedoms. This would have a distinctively negative effect on the second effect of achieving acceptance of the local populace. Should the commander direct the patrols or not? That depends on the level of violence in the region and other factors.

The above example is compounded by another issue – the unknown relationship between the completion of a task and the effect achieved. This is often a data problem. For example, when we were asked to send a team to Afghanistan to develop an assessment system, a General Officer in the headquarters there stated, "When Home Depot wants to increase sales by 3% in an area the following Saturday, they know exactly how much they need to spend on advertising in the Thursday paper. I want that ability here with our Information Operations (IO) efforts. How much effect does sending out 1000 flyers have?" That insight certainly would improve our ability to achieve some objectives in Afghanistan. Unfortunately, not much marketing research data was

available on Afghanistan prior to 2001. Even since then, the country has been in such a state of turmoil any data to this end would be too tainted to provide reasonable insights.

3.2 Effects and Sub-Effects Mathematics

Another roadblock in the development of metrics for assessment is the lack of understanding of relationships between high level objectives and the sub-effects identified to achieve the objectives. Because of the lack of understanding of which sub-effects impact objectives attainment and by how much, staffs and commanders tend to shy away from defining a number – or equation on which to build their assessments.

For example, when trying to achieve the effect of "Ensure a stable environment", it is not too controversial to have "Provide a law enforcement capability" and "Provide an education system" as at least two of the sub-effects. The question arises, "how much of each do you need?" and "How much more of one brings you how much closer to achieving a safe and secure environment?"

We now turn to the computer application which integrates the value focused implementation of the effects assessment and then integrate both concepts into the Effects Based Assessment Support System (EBASS).

Chapter 4: The Technology and its Evolution

The D-PASS application, originally written using the Active Server Pages (ASP) technology, required fundamental changes to the code base in order to implement the objective evaluation and assessment functionality that we wanted to put into ANDAS. Having had numerous programmers work on the code, each with their own style and approach, the ASP code base had become almost unmaintainable and needed to be refactored and modified. It was determined that starting from scratch and implementing the use of data models and objects would

be the best approach. Additionally, the use of ASP as the front end and an Access database as the back end meant that the system was very platform dependent. These two factors led to the decision to move away from ASP and Access and create EBASS using the object-oriented language Java, and the JSP technology that it provided, and the Struts Framework. The MySQL™ database is used for the back end. The use of Java provides an object-oriented approach that greatly enhances code maintainability and reuse, provide greater modularity and extensibility, and provide the platform independence desired.

Web applications built using Java and Java Server Pages (JSP) require the use of an application server that can provide support for these technologies. The application server chosen for EBASS was Tomcat™. Tomcat™ is not only used as a servlet/JSP container, it can also be used as a stand-alone web server. This dual functionality allows EBASS to use Tomcat to serve its dynamic content and its static content as well. Since Tomcat™ has also been ported to all major operating systems, platform independence has been maintained. Tomcat is also closely coupled with the very popular web server Apache. If Apache is currently used within a unit's IT infrastructure, it is almost trivial to add the Tomcat functionality that allows the use of EBASS.

MySQL™ is a widely-used, open-source relational database that also provides platform independence because it has been ported to all the major operating systems. As an aside, an Open DataBase Connectivity (ODBC) driver for MySQL™ is freely available for the Windows platform. This driver allows a user to view, query, and develop reports from the EBASS database using Microsoft Excel or Access; tools that many users are comfortable using. This capability allows user to create custom reports or views without needing to write a single line of code. Although EBASS uses MySQL™ as its back end, EBASS has been written in such a way that converting it to use another database, such as Oracle™ or Sybase™, is trivial. Virtually any

database that provides a Java Database Connectivity (JDBC) driver may be used and will require minimal changes to the code.

The code base for EBASS is based on the Model-View-Controller paradigm and is constructed using the Struts Framework. The Model components are implemented using Java classes and represent the various entity models within EBASS, i.e. objectives, effects, etc. The View components are implemented using a combination of JSP, HyperText Markup Language (HTML), Javascript, and Struts tiles. These components are the pages presented to the user when the application is used. The Controller components are the "brains" of the application and consist of various Java servlets and Struts Actions. The servlets and actions are responsible for handling the CRUD (create, read, update, and delete) activities of EBASS.

Software Requirements:

The basic software components needed to support EBASS:

a. Java (JRE) 1.5

b. Tomcat™ 4.1 or higher

c. MySQL™ 4.1

The EBASS application also uses a third-party graphing package (Davisor Chart) to construct the history bar charts. This package is proprietary and requires a license, which can be obtained through Davisor's web site at www.davisor.com.

Hardware Requirements (Table 1):

The EBASS application has no specific hardware requirements and does not necessarily need its own dedicated machine; the application has been deployed on stand-alone servers, individual workstation PCs, and laptops. The number of concurrent users, maintaining acceptable system performance and responsiveness, and the number of services running on the

host machine should be used as guidelines in determining the hardware requirements for your organization.

Table 1. Processing Requirements

Item	Minimum	Recommended
Server	Pentium III processor or higher (or equivalent non-Intel based system)	Pentium IV or higher
RAM	512MB	1GB RAM recommended (with at least 256MB dedicated to the Tomcat Server)
Storage	5-10 GB depending on the amount of data maintained in the database and the frequency of formal assessments. (300-500MBs are required for support components and ~15MB for EBASS application files)	20-40 GB

Chapter 5: EBASS Interface

The EBASS interface has been modified numerous times in an attempt to meet the desires and needs of the client. However, it has some basic elements which provide its fundamental look and feel. For a more extensive linkage into the look, feel, and operations of EBASS, refer to the EBASS Users Manual in Appendix B.

Figure 7 is an example screen shot of the standard log-in screen for the tool. Users provide their identification (ID) reference and password to gain access to the tool. This user ID will allow the user to gain access to create, update, enter data, and/or view information based on the authorizations grated the specific User ID.

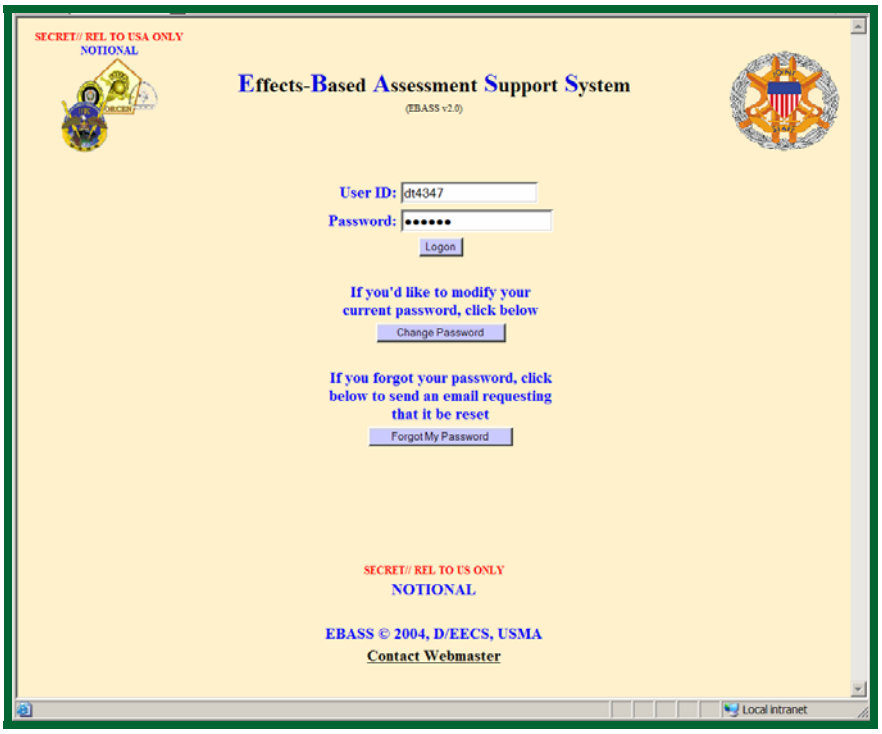

Figure 7. Effects-Based Assessment Support System Log-In Screen

Figure 8 is an example screen shot of the standard top level overview provided each user who desires to view the current level of assessment of the overall objective, the objective's supporting effects (SEs), the supporting sub effects (SSEs), and measures of effectiveness (MOEs). Only the level the user wish to drill down to see is viewable. The objective is always shown on this screen. The colored boxes represent the general status of the objective, SE, SSE, and MOE. Grey means no data has been inputted for one or more of the indicators; red means the aggregate value of the indicators, MOEs, SSEs, or SEs are below the pre-designated threshold for minimal satisfactory effect; amber is above the minimal threshold for a satisfactory effect but below the adequate effect as one or more major issues still exists; yellow is above the adequate threshold for satisfactory effect but below the goal effect level; and green means the goal effect for that level has been achieved.

Figure 8. Effects-Based Assessment Support System Top-Level Overview Screen

Figure 9 is an example screen shot of the information provided for each effect. On the right side of the screen is the Objective the effect is the child of. The right side of the screen provides a listing of all the supporting sub-effects for the effect and their current color code status. The color codes used in the historical bar graph (bottom center) and the sub-effects are the same as those used for Figure 8. The screen provides information on the date lasted updated, any narrative information to describe the reasons for the current status or recommendations to address and issues associated with the effect and any of its indicators. This allows subordinate elements to provide justifications and recommendations for short falls or predictions for potential issues. The square above the histogram provides the general color code status based on the overall goal for this effect and is the same as that seen on the over-view screen. The circle provides the status based on the predicted progress made on achieving the goal for this effect. Both the goal and progress predictors are set prior to the collection and input of data in order to prevent biasing of data.

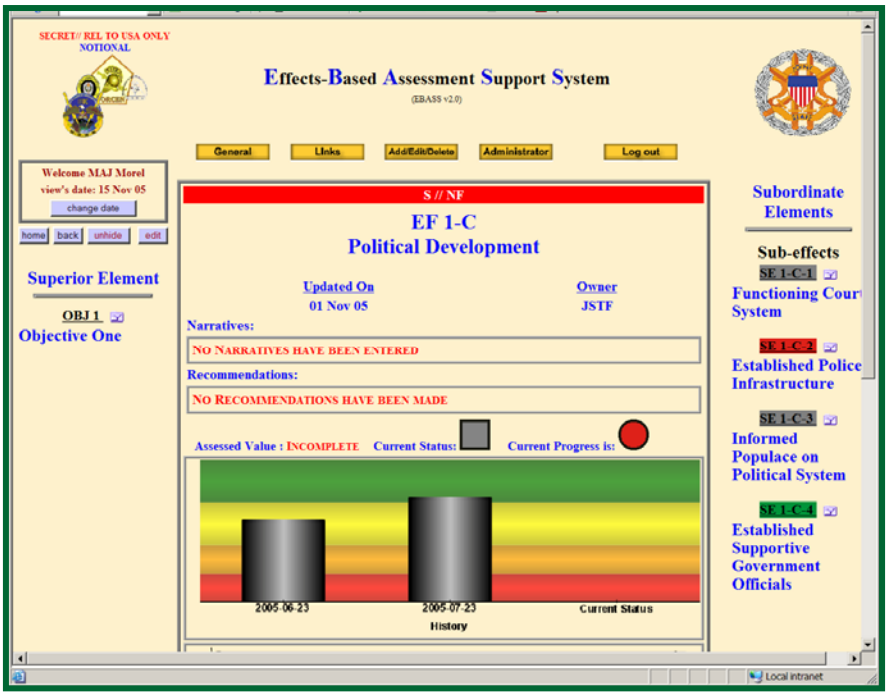

Figure 9. Effects-Based Assessment Support System Effects Assessment Screen

Figure 10 is an example screen shot of the goal histogram and progress chart available for each effect, SSE, MOE, and indicator. The histogram and progress chart provide additional visual representation of the trends for each of these elements.

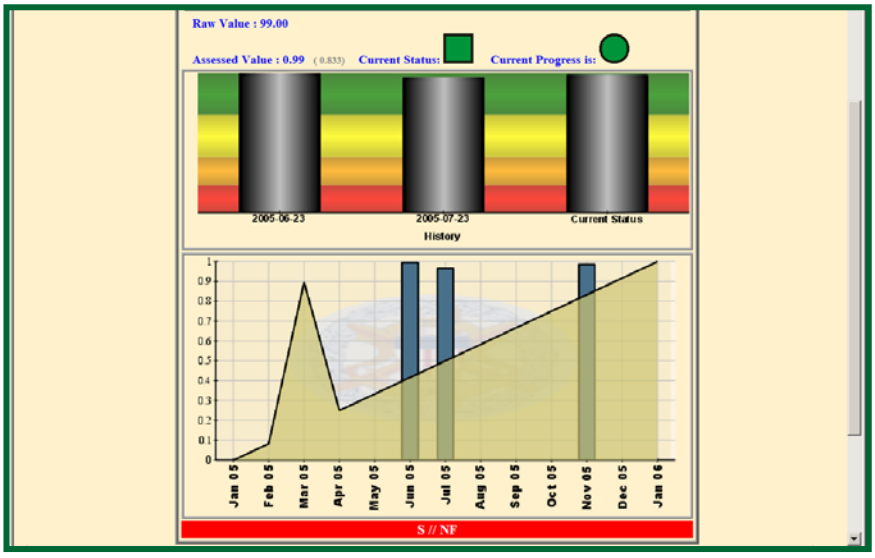

Figure 10. Effects-Based Assessment Support System Measure with Projection Assessment Screen

The example EBASS information interface screen shots are just one aspect of the tool. Two other components are the objective, SE, SSE, MOE, and indicator development screens as well as the indicator data input screens. For a more information on these aspects of the tool, refer to the EBASS Users Manual in Appendix B.

Chapter 6: Future Direction of Research

The system is ready to be fully deployed in its web-based configuration. The system is nearly fully verified in its functionality. It is currently deployed in Pacific Command, European Command and in Iraq. There must be a time for validation of the system prior to being able to rely on it to provide sufficient insights to direct future effects. We anticipate this taking only one or two months. The reason is that the command has been compiling most of the data required and will be able to generate data for past months allowing good insights into the system.

The system, as it is, is deemed to have too many measures to be useful long term. It may take too long for staff sections to input the data to ensure that the system is fully maintained. The LOOs within the Area of Operation in Afghanistan have already changed and will continue to change. There needs to be a means to allow for quick changes to the system. There will never be a "best" means to assess the situation for two reasons. First, the situation changes and therefore the system must change to provide good insights to direct effects. Second, this system is designed to provide insights to allow the commander to make decisions, therefore as the commander changes and the information needed to make those decisions, the system will have to change.

Chapter 7: Conclusion

Developing one comprehensive assessment system to analyze an entire theater of operations was a challenging proposition for the analysts. In the end, changing the command

structure changed the complexion of the problem and resulted in the limited acceptance of the product. This is a strong system based directly on quantitative analysis to provide the commander with the means to make more informed decisions. This is the role of the military analyst in supporting a combat commander.

The military analyst's role is not always easy. As this study shows, there are some who are very wary of quantitative assessments and methods. These are not always trusted because there is a belief they can be manipulated and that they can actually hide reality. The analyst must convince the commander that any system is reliable and at the same time is only there to provide the commander with the means to make more informed decisions.

The reality is that we live in a political time and one where the media has unprecedented access to information within a military command. Any system which provides definitive results – whether they accurately reflect the situation or are just open for interpretation – can possibly be used against the military or used politically. Commanders must be sensitive to this reality. Analysts must also be sensitive to this reality but we must provide the commander with what we believe is the best information possible. The next decision lies with the commander, but the final decision will be made by history.

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Appendix A: List of Abbreviations

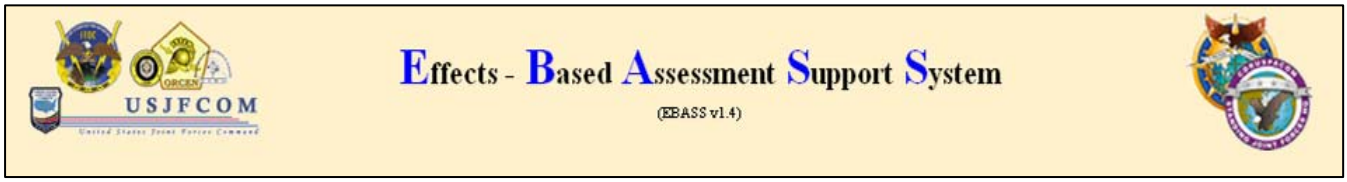
A	
ANDAS	Afghanistan National Development Assessment System
ASP	Active Server Pages
B	
BDA	Battle Damage Assessment
C	
CA/DSS	CENTCOM-developed Campaign Analysis / Decision Support System
CENTCOM	Central Command
CJTF	Coalition Joint Task Force
CJTF-180	Combined Joint Task Force 180 in Afghanistan
CRUD	Create, Read, Update, and Delete
D	
D-PASS	Dynamic Planning and Assessment Support System
E	
EBASS	Defense Technical Information Center
EBO	Effects-Based Operations
G	
GWOT	Global War on Terror
H	
HTML	HyperText Markup Language
I	
ID	Identification
IO	Information Operations
ITOC	Information and Technology Operations Center
J	
J5	Strategic Plans and Policy, Joint Staff
JDBC	Java Database Connectivity
JFCOM	Joint Forces Command
JSP	Java Server Pages
JTF	Joint Task Force
L	
LOO	Lines of Operation
LTC	Lieutenant Colonel
M	
MAJ	Major
MNF-I	Multi-National Force Iraq
MOE	Measures of Effectiveness

O	
OEF	Operation Enduring Freedom
ODBC	Open DataBase Connectivity
OIF	Operation Iraqi Freedom
ONA	operational network assessment
ORCEN	Operations Research Center
P	
PACOM	Pacific Command
PMESII	Political, Military, Economic, Social, Information, and Infrastructure
POC	Point of Contact
R	
RCC	Regional Combatant Command
S	
SE	Supporting Effect
SJFHQ	Standing Joint Forces Headquarters
SSE	Supporting Sub Effect
U	
UML	Unified Modeling Language
USMA	United States Military Academy
V	
VFT	Value Focused Thinking

*This table is sorted alphabetically

Appendix B: EBASS User Manual

This appendix provides the EBASS Users Manual to assist the user in utilizing EBASS. If desired, the User's Manual can be extracted from the technical report for use as a standalone document.



EBASS
User's Guide

Table of Contents

Chapter 1 Introduction to EBASS

The Effects-Based Assessment Support System (EBASS) evolved from a system called the Distributed Planning and Assessment Support System (D-PASS). D-PASS was created to aid Coalition Joint Task Force 180 (CJTF-180) in the Future Operations planning for the Operation Enduring Freedom campaign in the Coalition Joint Operations Area, Afghanistan. It was developed by a team of officers from the United States Military Academy at West Point, New York, who augmented the CJTF Plans section at Bagram Air Base, Afghanistan. D-PASS was a semi-automated tool that relied on input from staff and component members. EBASS evolved from D-PASS based on requests for change from Joint Forces Command (JFCOM). In collaboration with JFCOM and the Operations Research Center (ORCEN) at The United States Military Academy, West Point. This version of EBASS has been deployed to Multi-national Force – Iraq and Standing Joint Forces Headquarters (SJFHQ) in the Pacific Command, European Command, Southern Command, and Special Operations Command areas of operation.

EBASS is a web-based application that allows action officers to enter data via the Internet. The data is input at the Indicator level and is consolidated and normalized. The normalized value is then propagated up the hierarchy to the parent measure of effectiveness (MOE), then the parent effect of that MOE, and finally to the parent objective. The normalization process results in a value between zero and one that reflects the relative effectiveness of a particular Objective, Effect, or Measure of Effectiveness.

The system currently does not employ any expert system technology, but it is feasible that it could be included in future versions. Before delving into the details of EBASS operations, it is important for you to understand key terms and concepts, as well as the assessment methodology employed by the system. The following terms play an integral role in EBASS:

Objective – The desired end-state as a result of an operation.

Effect – The physical and/or behavioral state of a Political, Military, Economic, Social, Information, and Infrastructure (PMESII) system that results from a military or non-military action or set of actions.

Measures of Effectiveness (MOE) – Criteria used to evaluation how actions have affected system behaviors or capabilities. The MOEs are tied to Effects and effects assessment.

Indicator – Events which occur and lend a degree of "proof" for an MOE that an Effect is being accomplished. When entering Indicators ensure they are clear and concise, similar to a newspaper headline, and related to an MOE.

The assessment methodology used within EBASS is built upon indicators, which are entered into the system and then linked to MOEs. A single indicator can support more than one MOE. The Indicators support MOEs, which support Effects, which support Objectives. The assessment at each level is based upon the assessments of the items at the next lower echelon, with the Indicator being the lowest level. Therefore, the assessment of an Effect is derived from the assessment of the MOEs that support it. At regular intervals, a formal assessment of the

entire hierarchy is made. This formal assessment creates a "snapshot" of the database and results in an additional entry in the assessment history of the database.

Individuals within a headquarters are designated as "owners" for levels within the assessment hierarchy from Objectives, at the top, down to Indicators at the bottom. The owner is responsible for ensuring that an assessment for the item for which he/she is the owner has been completed within the designated timeframe. Additionally, the owner supervises the assessments done by owners of lower echelon elements which support his/her items. This will ensure that the assessment is rational, that the indicators which support the assessment have been input into EBASS and linked to the appropriate MOE, and that the assessment is consistent, from MOE on up, within the appropriate hierarchy.

Chapter 2 User Accounts

EBASS has three types of accounts: Each account type has specific user capabilities (Figure 3-7). The account type is determined by the EBASS Administrator. The three account types are:

Viewer: The Viewer account has a baseline set of capabilities which allow the individual to view current and historical unrestricted assessment information. Viewers cannot add or change any information within the system.

User: The User account is the most common and allows users to view current and historical assessment information, to include restricted portions, and make changes to current assessment information (the working copy of assessment staff work between formal assessments).

Administrator: The Administrator account provides all rights and privileges available within the system. The EBASS system normally has only one administrator account.

All proponents within an organization may have User accounts as well as Viewer accounts.

An account is obtained by having your proponent POC send an email to the EBASS Administrator. Once your user information is entered you will receive an email with your *userID, password*, and additional instructions. The information required for an account is as follows:

- Account Type: User or Viewer
- Full Name: first, last, middle initial
- Rank or Grade
- DSN phone number
- Commercial phone number
- Organization name
- SIPR Email address

Chapter 3 Overview of Functionality

EBASS allows users to perform a myriad of tasks and operations upon the database. This guide provides guidance on how to perform these specific tasks. It does not provide an explanation of the "doctrinal" process by which organizations can use EBASS to assist them in their assessment process. This chapter will focus on tasks that are available to Viewers, Users, and Administrators. Keep in mind that not all types of accounts can perform all of the functions presented in this chapter. Viewers can neither view restricted information nor edit any assessment information. Additional administrator account functions will be detailed in the next chapter.

Login

Login to EBASS by entering your user ID and password on the initial screen. (Figure 3-1)

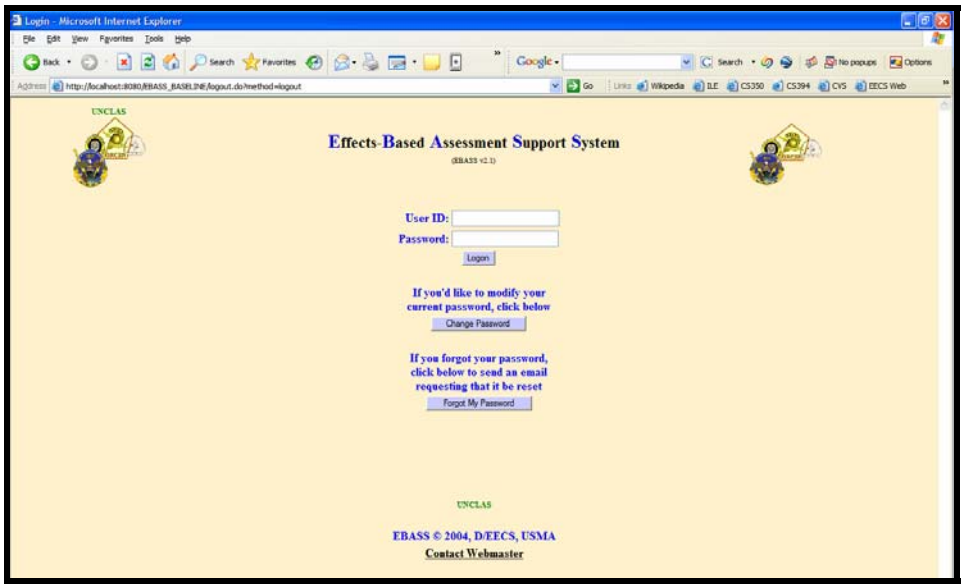


Figure 3-1. EBASS Login Screen

Change User Password

To change your password, click the "change password" button. Follow the on-screen instructions and your password will be changed immediately. Once you submit your new password, you will be returned to the main login screen. You must now use your new password to login.

Forgot My Password

If you forget your password, click the "Forgot My Password" button. Pressing the button will generate an email addressed to the EBASS Administrator. Type a short message to the administrator requesting that your password be reset.

Once you've successfully logged in, the opening screen lists the Objectives that your organization is responsible for assessing. If there are no Objective-level items assigned to your organization the list will be blank. (Figure 3-2)

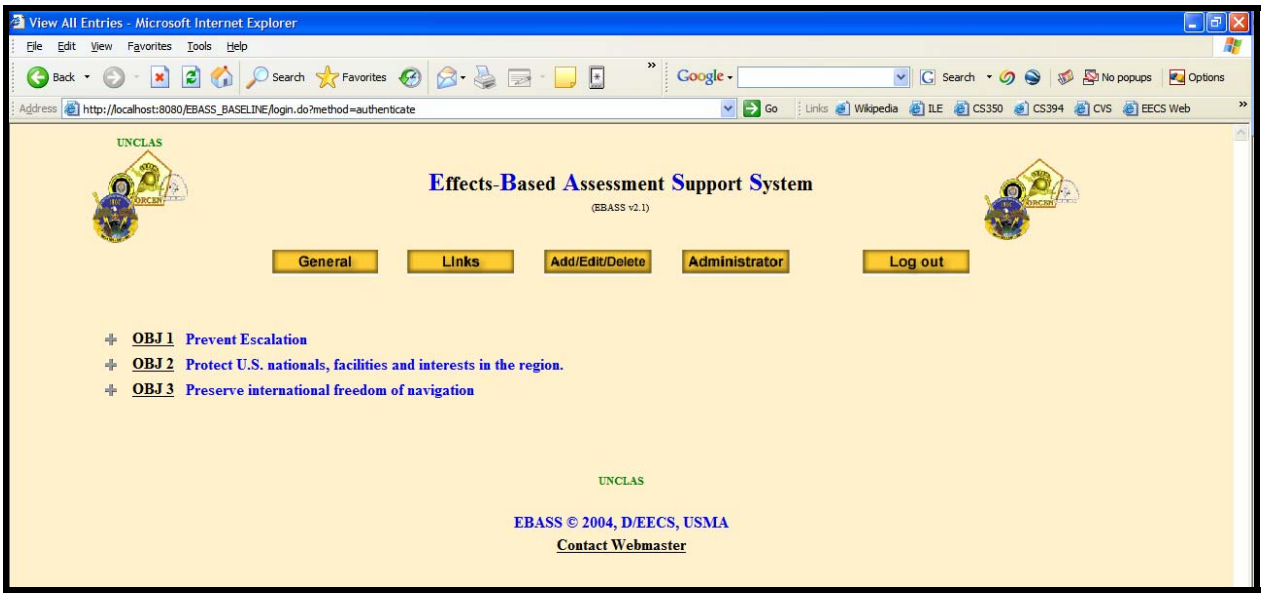


Figure 3-2. Top-Level View – Initial Screen after Logging In

Once the user has logged into the system, the individual can perform any function available to them by simply clicking one of the drop-down menus at the top of the screen. The menus appear when you place the mouse over any of the buttons shown in Figure 3-3 below.

Menu Description

Figure 3-3. Main Menu – Administrator-Only Items Are Circled

The General Menu

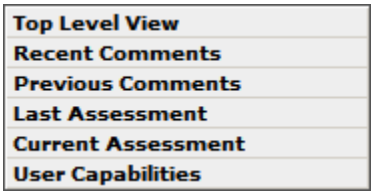


Figure 3-4. General Menu

Top Level View: This option will list the Objective-level elements that are currently maintained in the database. This is the same as the list you received when you logged in.

Recent Comments: This option will show all of the comments and narratives that have been added since the last formal assessment. For example, if the database has formal assessments for 1 Jan and 1 Feb, and the current assessment you are working on is dated 25 Feb, this option will show the comments added between 1 Feb and 25 Feb.

Previous Comments: This option will show all of the comments and narratives that were added during the last formal assessment. Continuing with the example given in the previous paragraph, this option would return all the comments that were entered between 1 Jan and 1 Feb.

Last Assessment: This option will display a consolidated review of the last formal assessment. (Figure 3-5)

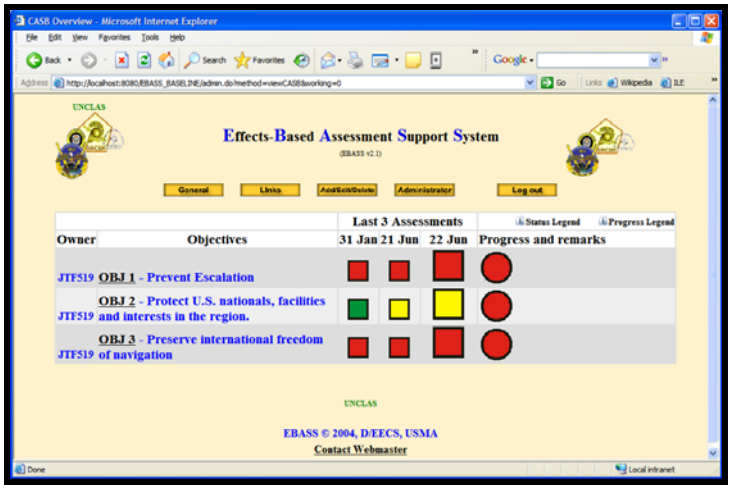


Figure 3-5. View Previous Assessment

Current Assessment: This option will display a consolidated review of the working assessment. (Figure 3-6)

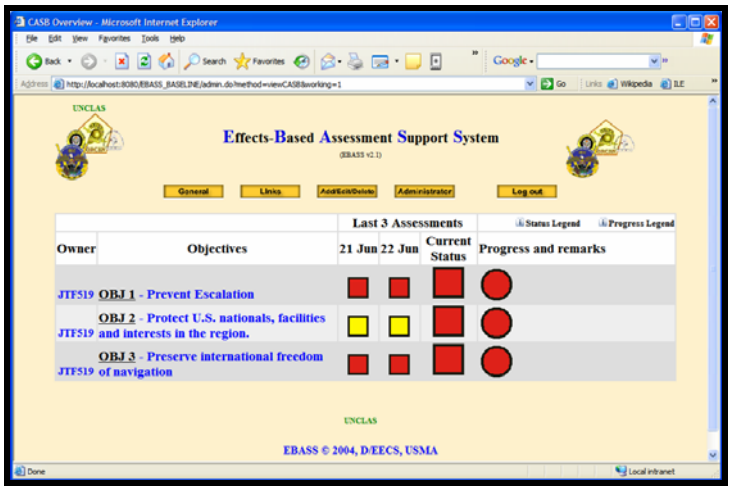


Figure 3-6. View Current Assessment

User Capabilities: This option lists the capabilities for each user-level (Figure 3-7).

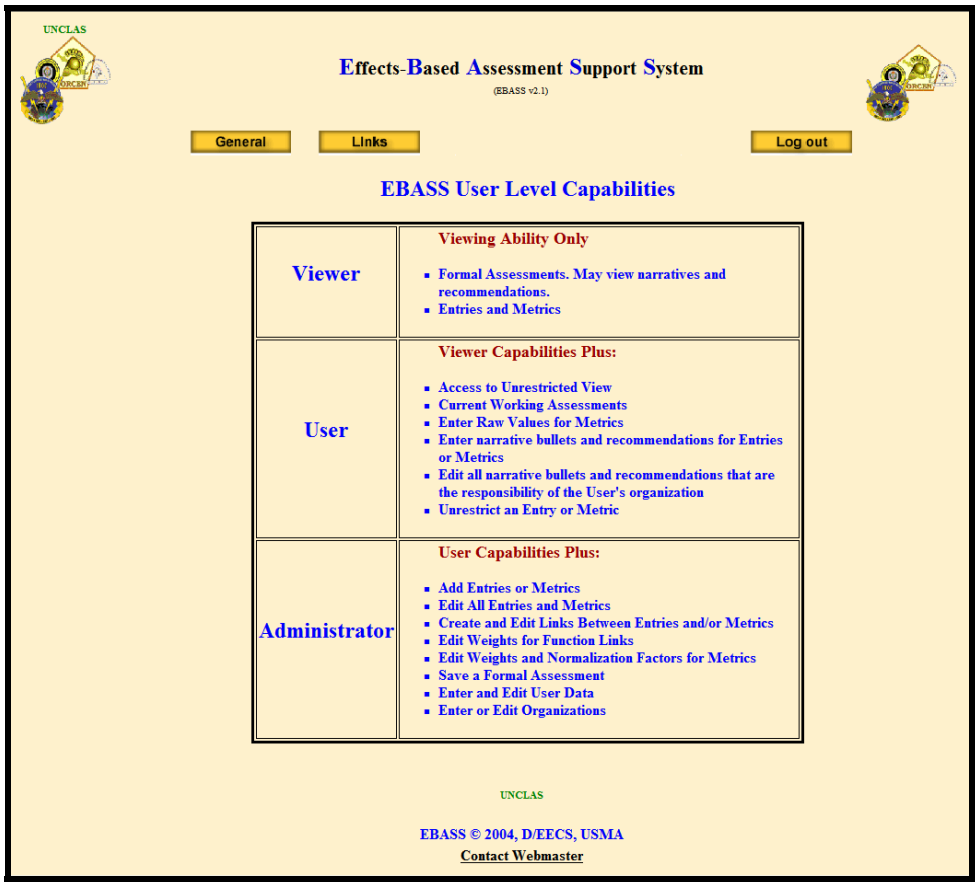


Figure 3-7. User Capabilities

The Links menu

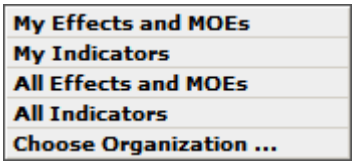


Figure 3-8. Links Menu

My Effects and MOEs: This option will list all Objectives, Effects, and MOEs that your particular organization is responsible for assessing.

My Indicators: This option will list all the Indicators that your particular organization is responsible for assessing.

All Effects and MOEs: This option will list all Objectives, Effects, and MOEs that are contained in the current database, regardless of which organization is responsible for them.

All Indicators: This option will list all the Indicators that are contained in the current database, regardless of which organization is responsible for them.

Choose Organization …: This option will allow you to list all of the Effects, MOEs, and Indicators for a particular organization. As show in Figure 3-9 and Figure 3-10.

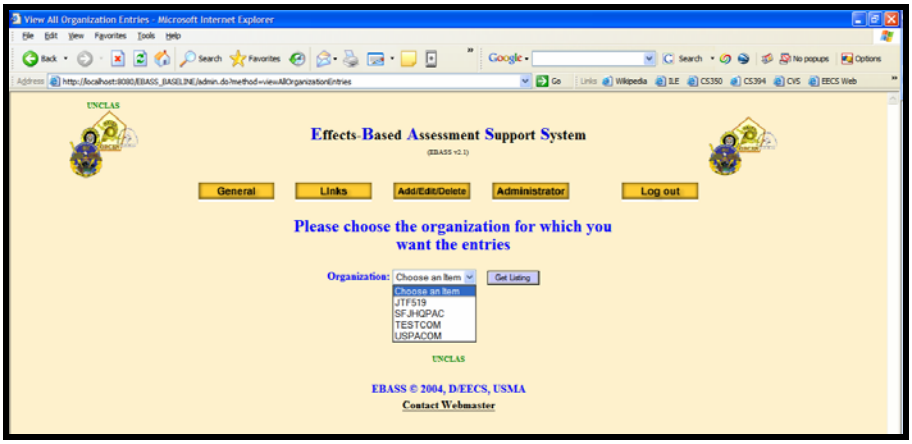


Figure 3-9. Select an Organization

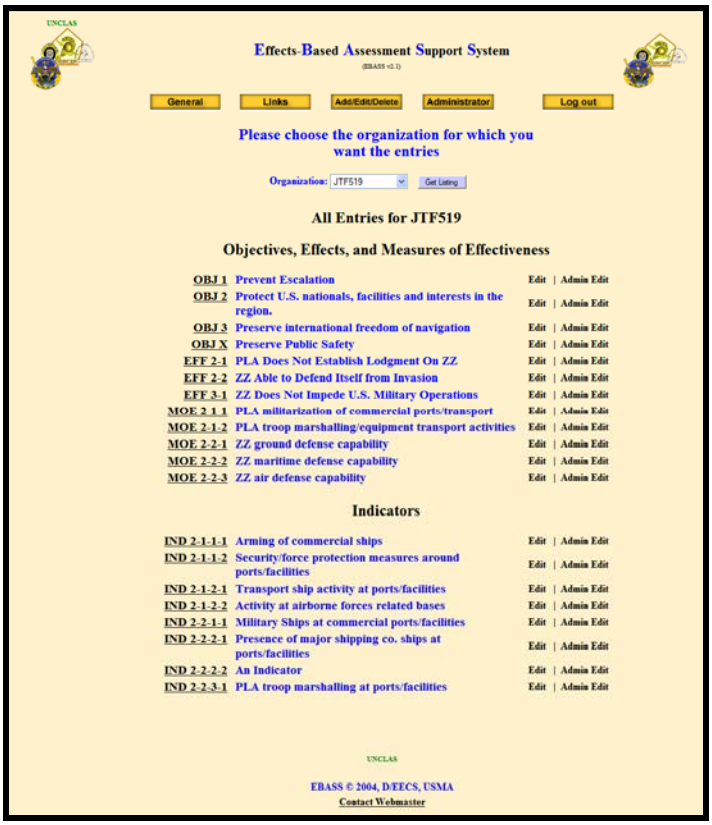


Figure 3-10. All Elements for a Particular Organization

The Logout menu

The Logout menu will close your active session with the system and log you out of EBASS.

EBASS Basics

Assessments

There are two types of assessment within EBASS: Working and Formal.

Working Assessment: This type of assessment is the action officers' working document for a particular item and shows its current status. Because this is a working document, any and all elements of the item may be changed at any time. An assessment is considered working until the EBASS administrator executes a formal assessment of the system. At that point, the working assessment becomes formalized and a new working assessment is created.

Formal Assessment: A formal assessment is a historical snapshot of an item on a particular date or time. No changes can be made to an item once it has been formalized.

Main Screen Orientation

From the General Menu, choose Top Level View, then click on one of the items that are listed. The screen that appears once you've selected an item is show at Figure 3-2Figure 3-11 below.

The center of the screen shows the current "working" assessment of the item; in this case it is the working assessment for the item "EFF 2-2." The graph shows the history of the assessments for that particular item. More detail about the current assessment is discussed below.

The left side of the screen shows the Navigation and Edit submenu and the Superior Elements (parents, if you will) of the item. In this case, "OBJ 2" is the parent, or superior element, for this effect. A superior element may be selected by clicking on it.

The right side of the screen shows the Subordinate Elements (children, if you will) of the current item. In this case, "EFF 2-2" has three MOEs (MOE 2-2-1, MOE 2-2-2, and MOE 2-2-3) as children. Also note that the highlight color for each subordinate element represents its current color status such as red, yellow, green. A subordinate element may be selected by clicking on it.

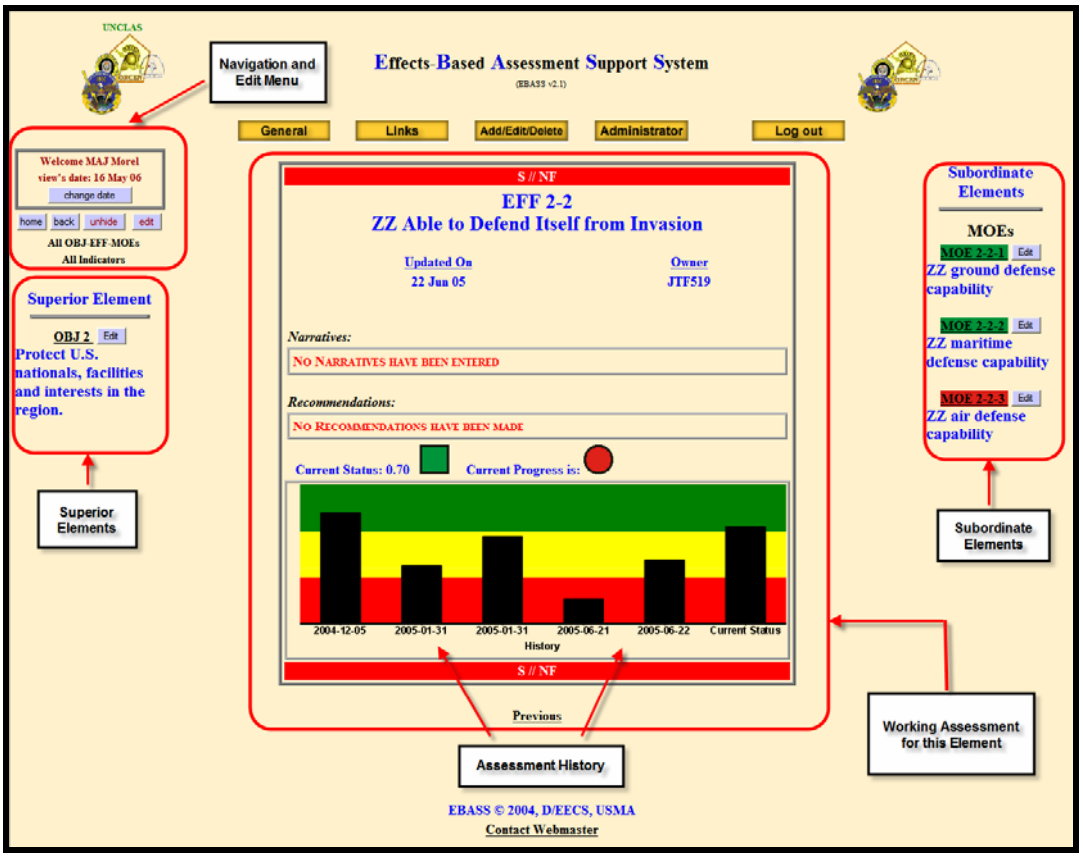


Figure 3-11. Viewing an Assessment in "View" Mode

Navigation and Edit Menu

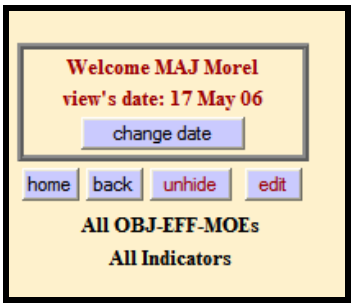


Figure 3-12. Navigation and Edit Menu

The Navigation and Edit menu has five buttons and two quick links. The button functions are as follows:

Change date: This button allows the user to select a specific date for which they would like to see an assessment. When pressed, the change date button will cause a calendar to appear in a pop-up window. The user selects a date for which they want to retrieve an assessment and that assessment appears. For example, if the user wants to see the assessment done on 1 April 2005, the user would click the button and select the appropriate date. The assessment that was done on that date, or the last assessment done before that date, will appear.

Home: Pressing this button will return the user to top level view.

Back: Pressing this button will take the user back to the previous screen. This button can be pressed repeatedly to go back further. ✧*Note that pressing the back button returns the user to the previous screen without refreshing that screen. That means that if a user has updated a value, saves it, then continues to press "back" to review the element again, the element's updated value won't necessarily be reflected. The user will need to press refresh in order to update the screen.*

Unhide: Pressing this button will reveal additional information about the subordinate elements (Figure 3-13). This button will also reveal any hidden or deleted text contained within the narratives and recommendations for the assessment being viewed (Figure 4-2 and Figure 4-3). Once pressed, this button will then be titled "hide" which will then hide the additional information once again. ✧*Note that the Unhide button only appears if you are the owner of the element being presented or if you are a system administrator.*

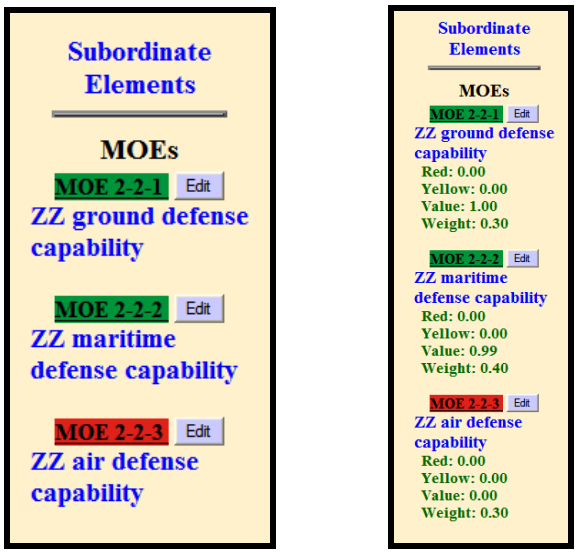


Figure 3-13. Viewing "Hidden" Subordinate Element Data

Edit: Pressing this button will allow the user to edit the working assessment versus just viewing it. Once pressed, the button will be titled "view" which will then return the user to view mode. ✧*Note that the Edit button only appears if you are the owner of the element being presented or if you are a system administrator*.

Taking a closer look at the center portion of the screen (Figure 3-14), you will see the administrative-type data for the item (title, last updated on date, owner, etc.) Additionally, you can see the history of the assessments for this item. The "working" assessment is illustrated by the right-most bar on the graph while the others are formal assessments. The height of the bar represents the item's current assessed value, which corresponds to the colored circle and assessed value under the heading "Current Status" on the left-hand side of the screen.

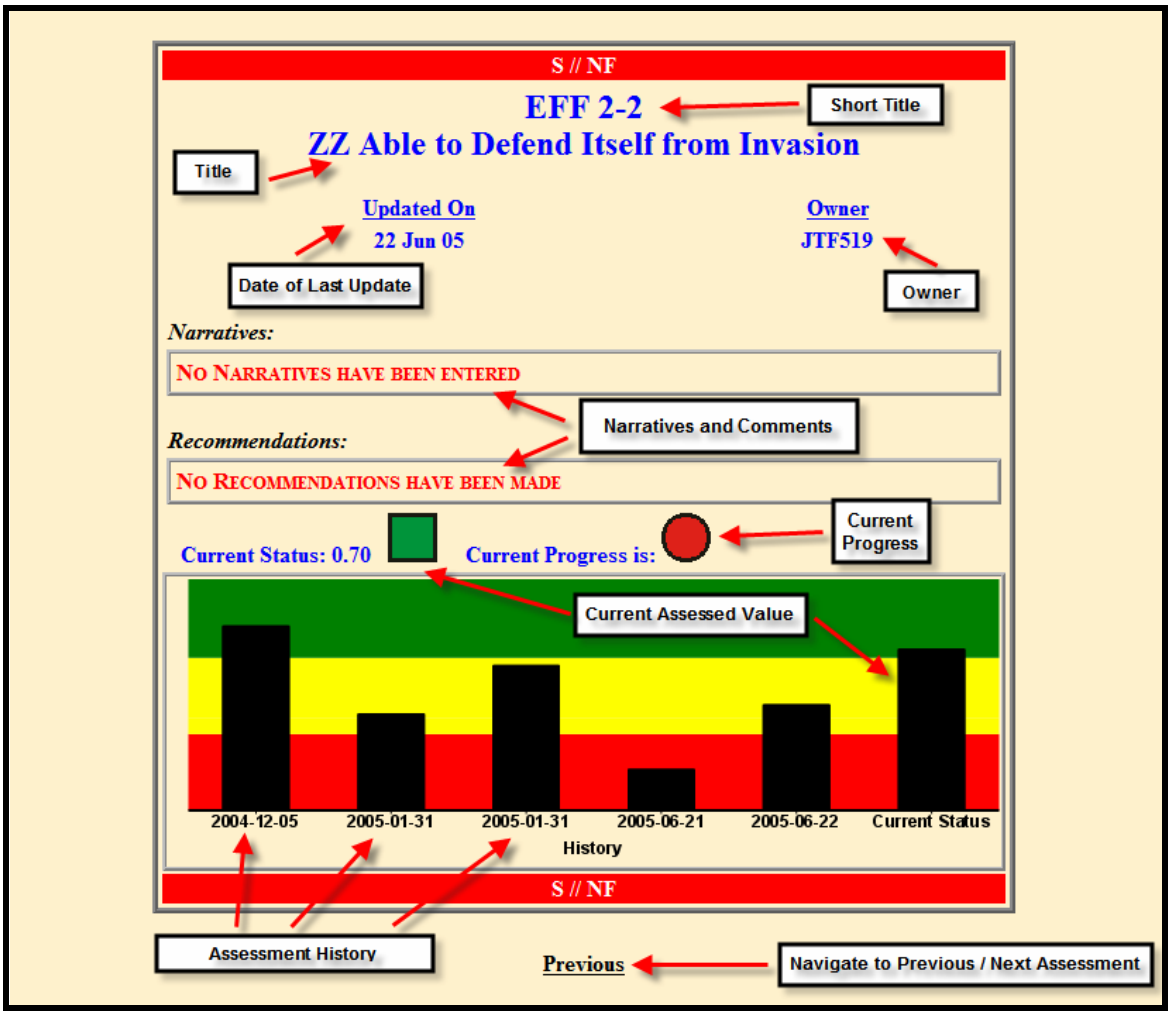


Figure 3-14. Center Portion of the Assessment Screen in Edit Mode)

The Current Status color indicates the color associated with the assessed value. The defaults for EBASS color statuses are Red (0-0.33), Yellow (0.34 – 0.66) and Green (> 0.66). The assessed value is a value between 0 and 1.0 that is calculated based on the assessed values of any subordinate elements and the weights assigned to each of the subordinate elements. As an example, note the weights and values for the subordinate elements in Figure 3-13 above.

The Current Progress color indicates the current assessment value relative to what the expected level of achievement is for this assessment period. For example, if the current assessment status is red, and the expected level of achievement for this date was red, then the Current Progress would be green; indicating that our current assessed level is exactly, or slightly higher, than what was expected during this assessment period. However, if the current status was expected to be yellow at this point in time, and the current assessment status is red, then the progress color could be yellow, meaning that the actual status is "slightly behind" the expected level.

Historical assessments can be seen by clicking the "previous" or "next" link at the bottom of the screen. Historical assessments can also be seen by clicking the "change date" button on the Navigation and Edit Menu on the left-hand side of the screen. A small calendar will appear. Navigate to, and click on, the desired date. The assessment whose assessment date is less than or equal to the requested date will be displayed.

Chapter 4 Editing Elements

This chapter describes how to edit the elements of the assessment structure.

Editing an Objective, Effect, or MOE

An objective, effect, or MOE can be edited by pressing the "edit" button on the navigation and edit menu on the left-hand-side of the screen. This results in the screen shown in Figure 4-1.

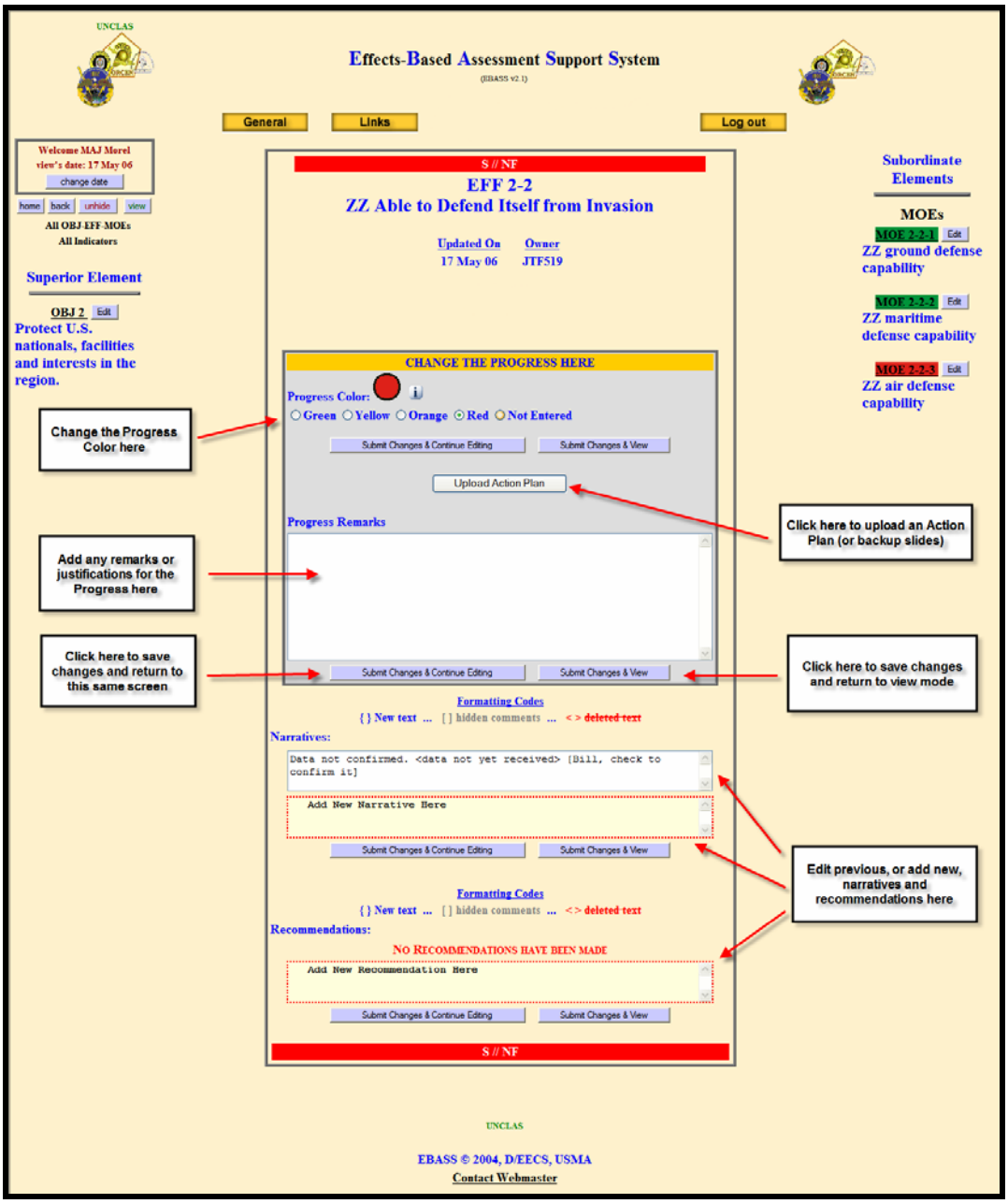


Figure 4-1. Edit Screen for an Objective, Effect, or MOE

The editing screen allows the user to perform the following actions:

- **Progress Color**: The progress color can be changed by clicking the radio button in front of the desired color. The default value is gray (not entered). This color selection is subjective and has no effect on the assessed value of the element. ✧*Note: Unlike the assessed value, which is propagated from an indicator up through the hierarchy, the progress color does not propagate up. This means that the progress color must be set for each element independently.*

- **Progress Remarks**: Remarks may be entered to explain or provide justification for the progress color chosen. The remarks entered here are only shown on the consolidated review pages of the last or current assessment menu item on the "General" menu at the top of the screen. Progress remarks are optional.

- **Upload Action Plan**: This option only appears when editing an effect. It allows the user to attach an action plan to an element's current assessment. An action plan is a PowerPoint slide(s) that provide(s) an explanation as to why the progress of this element is not green and what actions will be taken to get it to green. The uploading of action plans is optional. ✧*Note that only PowerPoint slides are currently supported by EBASS.*

- **Upload New Slides**: This option only appears when editing an MOE. It allows the user to attach backup slides to an element's current assessment in the event that additional background information is needed. The uploading of slides is optional and may not be used in your organization. ✧*Note that only PowerPoint slides are currently supported by EBASS.*

- **Narratives and Recommendations**: Previously entered narratives and recommendations can be edited here and new narratives and/or recommendations can also be added. Narratives are used to provide background or pertinent information that pertains to the assessment of this item. Recommendations are used for making recommendations to the next higher element owner as to your recommended course of action, if any. Narratives and recommendations can be formatted using the formatting codes shown on the screen. Enclosing text in curly braces {} will identify the text as "new" information. Enclosing the text in square brackets [ ] will "hide" the comments. This means that the text will not appear in the narrative shown on the viewing screen unless the "unhide" button has been pressed. Hidden text is displayed in gray. Formatting text as hidden allows the action officer to include additional notes and/or remarks that he/she doesn't necessarily want others to see. Enclosing the text in angle brackets < > will strike-through the text and color it red. Deleted text can be used to "remove" notes or remarks that are no longer valid but perhaps the action officer wants to retain them for historical purposes. Figure 4-2 and Figure 4-3 below illustrate how a narrative appears when it is restricted and unrestricted with various formatting codes used within the text.

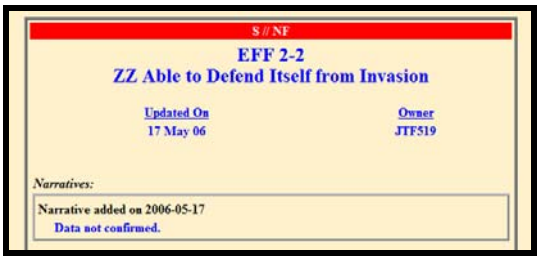


Figure 4-2. Restricted View of Narratives

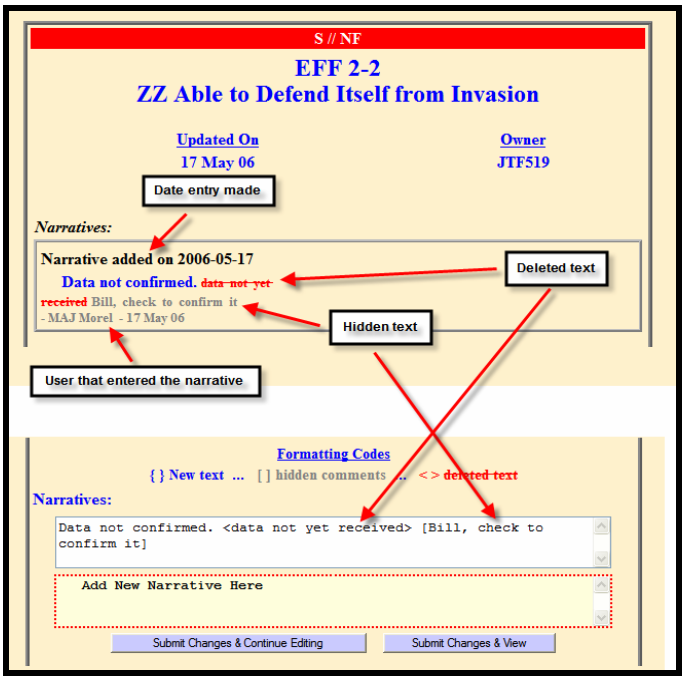


Figure 4-3. Unrestricted View of Narratives on Top, Edit Screen on the Bottom

Uploading Slides

The process for uploading slides is the same whether it is to upload Action Plan slides for an Effect or to upload backup slides for an MOE. The following steps need to be done to complete the upload.

1. Click the "Upload Action Plan" or "Upload New Slides" on the edit screen (Figure 4-1 above).
2. Click the "Browse …" button and navigate to the location where the slides to be uploaded are located. (Figure 4-4)
3. Select the file to be uploaded and press "Open."
4. Press "Submit."
5. Once the successful upload page appears, press "Return to …" to return to the edit screen. (Figure 4-5)

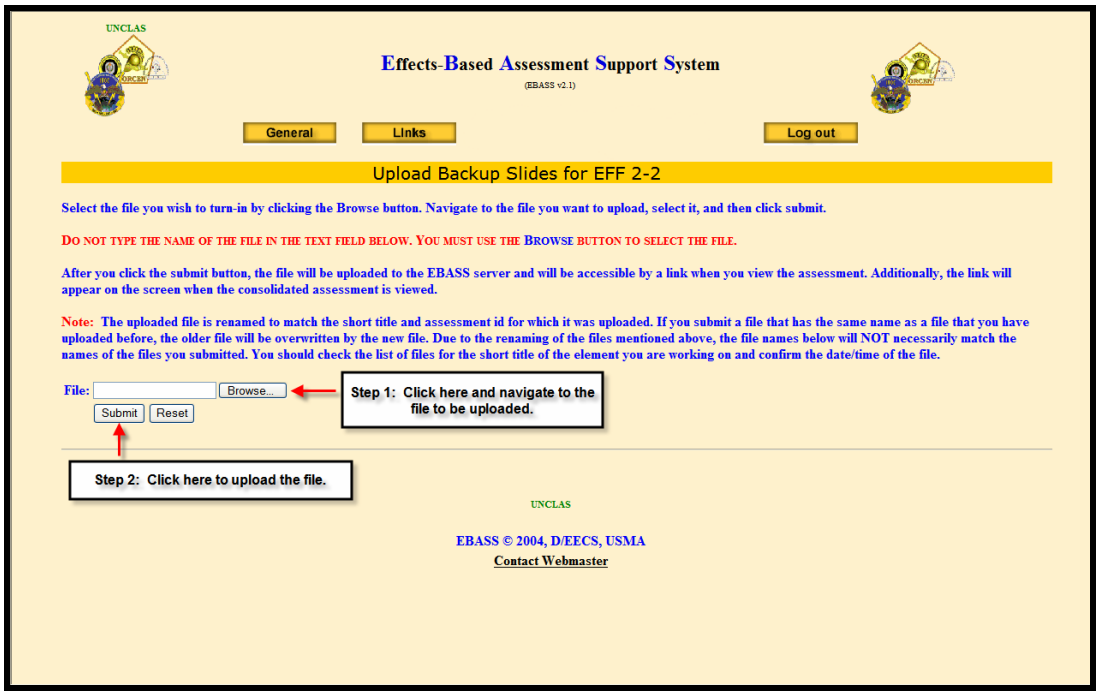


Figure 4-4. Initial Upload Slides Screen

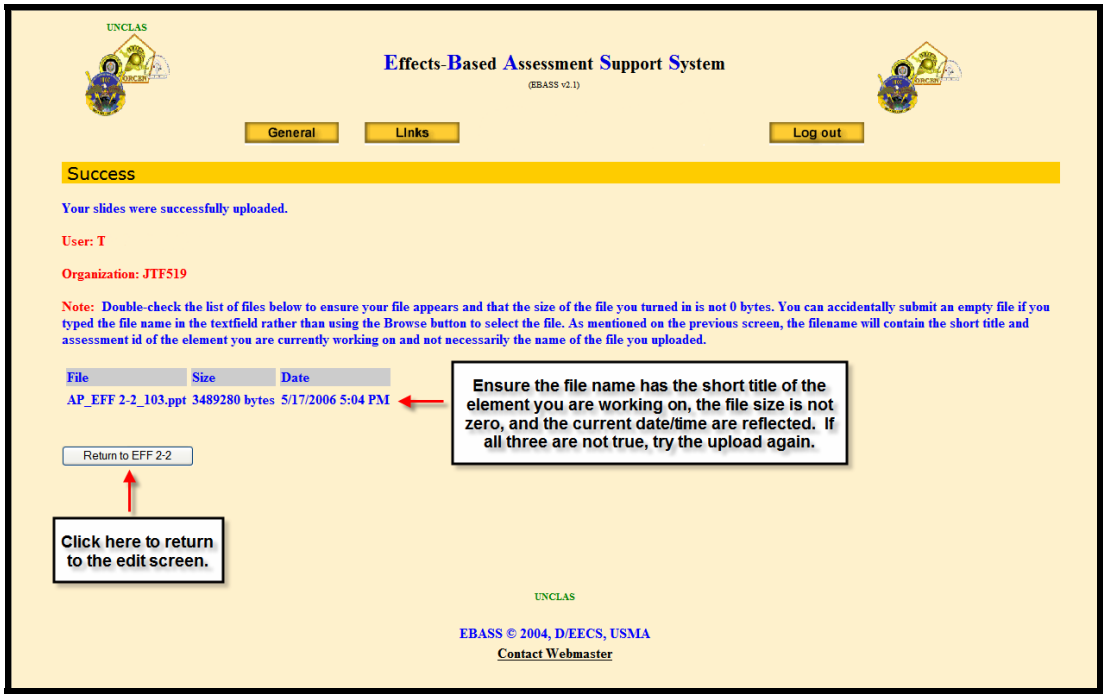


Figure 4-5. Successful Upload Screen

Once the slides are uploaded, the edit screen will reappear. It will now have different button options for the slides. You can now upload different slides, view the current slides, or delete the slides (Figure 4-6).

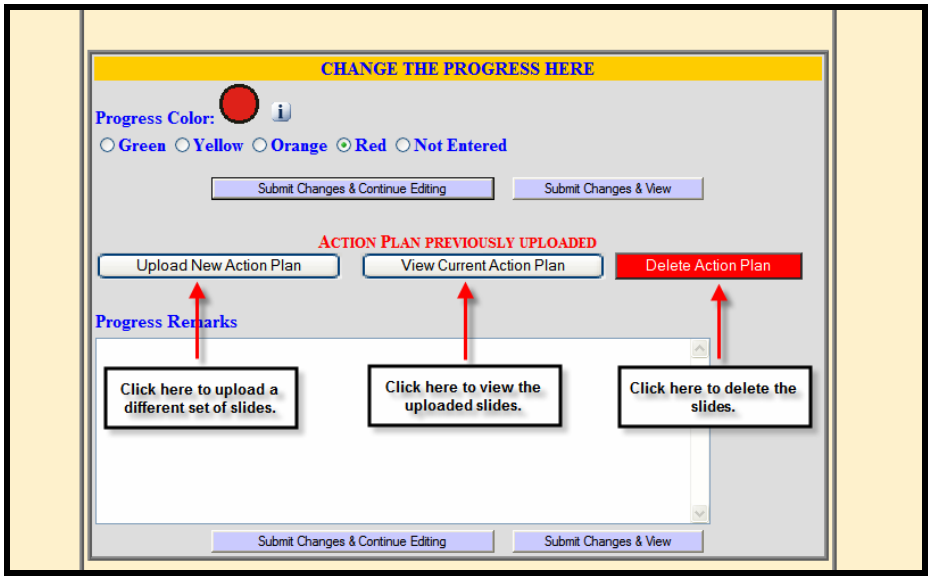


Figure 4-6. Updated Button Panel After Slide Upload

Submitting the Changes

Once the appropriate data has been entered or changed, it needs to be submitted. There are two submission buttons: Submit Changes & Continue Editing will submit the changes and will return you to the same screen you are on. Submit Changes & View will also submit the changes but will return to you the "view" screen instead of the current editing screen. Figure 4-1 illustrates both submission buttons.

Editing an Indicator

An indicator is viewed and edited in the same way as shown above for objectives, effects, and MOEs. However, it is the indicator level at which raw values are input. These inputs can be of two types: Natural-scale and Discrete-scale.

Natural-scale indicators have actual values as inputs, such as 50, 3.7 or 0. An additional data item, Raw Value, appears on the screen when a natural-scale indicator is viewed (Figure 4-7). The raw value represents the actual value entered by the user for that particular indicator. For example, the value could represent the percentage of combat-ready vehicles within a unit or the number of personnel being detained. The edit screen for a natural-scale indicator provides an input area for the raw value and also shows the minimum and maximum values that can be entered (Figure 4-8). The number input is then normalized to a value between 0 and 1.0, resulting in the assessed value. The normalized value is derived from criteria set forth when the indicator was entered into the system. The details of these criteria are discussed in Chapter 6.

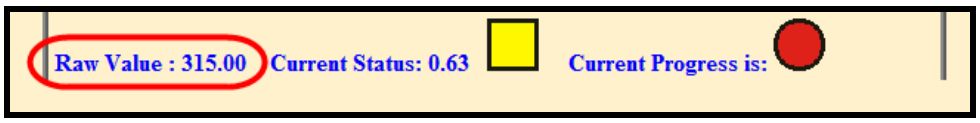


Figure 4-7. Raw Value Indicator for a Natural-Scale Indicator

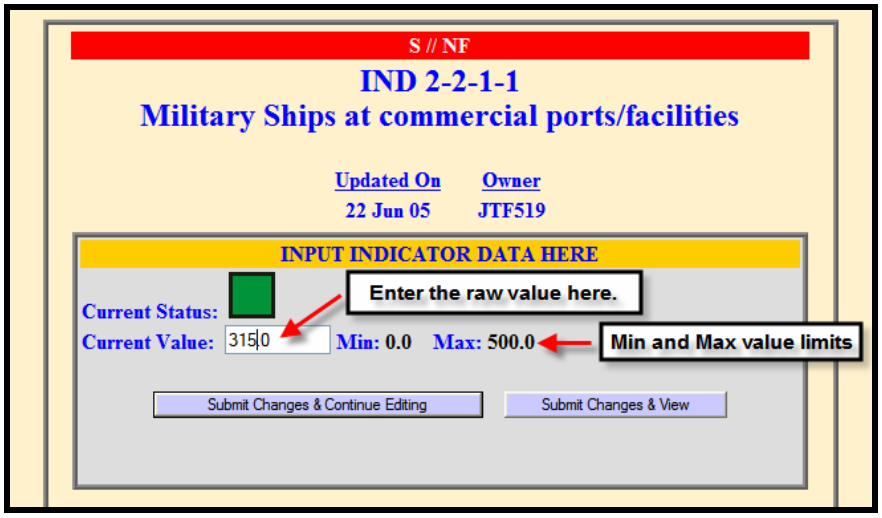


Figure 4-8. Edit Screen for a Natural-Scale Indicator

Discrete scale indicators provide the user with a drop-down menu to enter the raw value rather than entering an actual number. For example, in Figure 4-9 below, the user has the option of choosing "Low", "Med", or "High." The normalized value will represent the selection the user made such as 0.0 for "Low" or 0.5 for "Med", and perhaps 1.0 for "High." Like a natural-scale indicator, the normalized value is derived from criteria set forth when the indicator was entered into the system. The details of these criteria are discussed in Chapter 6.

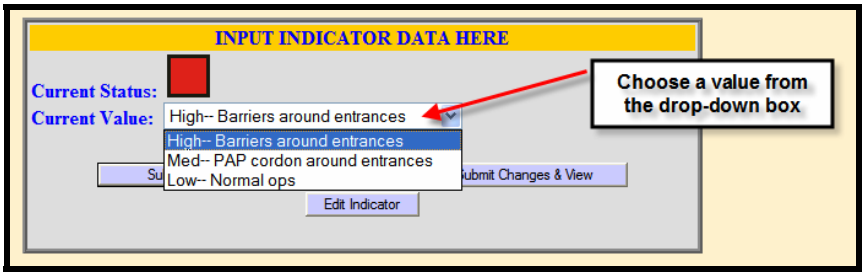


Figure 4-9. Edit Screen for a Discrete-Scale Indicator

The progress color, progress remarks, narratives, and recommendations for indicators are updated in the same manner as discussed for objectives, effects, and MOEs.

Chapter 5 Administrator's Menu (Administrator Only)

A user identified as an administrator will have two additional buttons on the main menu (Figure 5-1). The two additional buttons and their submenus are discussed below.

Figure 5-1. Administrator Menu Options

Add/Edit/Delete

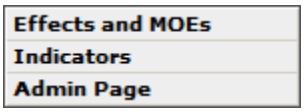


Figure 5-2. Add/Edit/Delete Menu

Effects and MOEs: Selecting this option will allow the user to add or edit an objective, an effect, or an MOE. The details to add and edit these elements are discussed in Chapter 6. An example of the page that appears when this item is selected is at Figure 6-2.

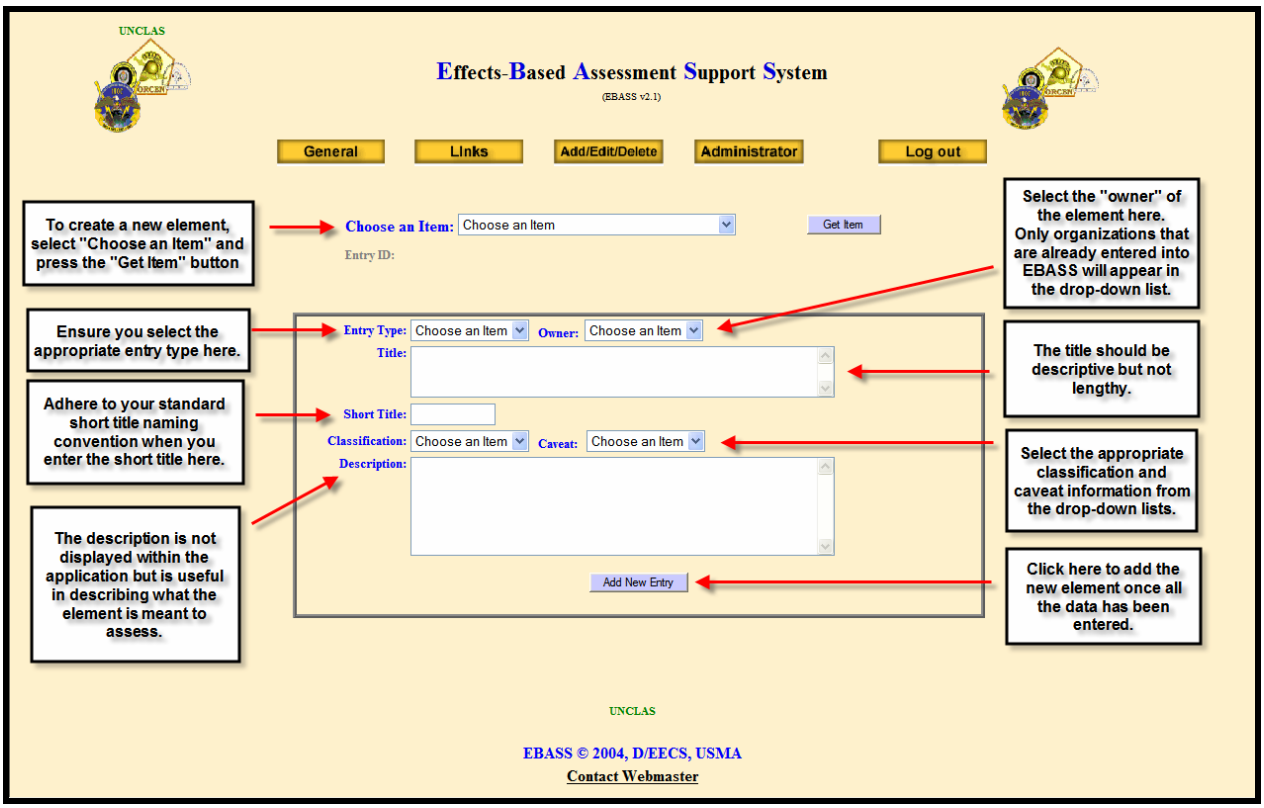


Figure 6-2. Effects and MOEs

Indicators: Selecting this option will allow the user to add or edit an indicator. The details to add and edit indicators are discussed in Chapter 6. An example of the page that appears when this item is selected is at Figure 6-6.

Admin Page: Selecting this option will allow the user to see the entire hierarchy for a particular objective, effect, or MOE. This option is used as a shortcut to allow the user to see the entire hierarchy for the element chosen and provides links for various options that can be taken on the items displayed. Figure 5-3 below shows the initial screen that allows the particular element to be chosen.

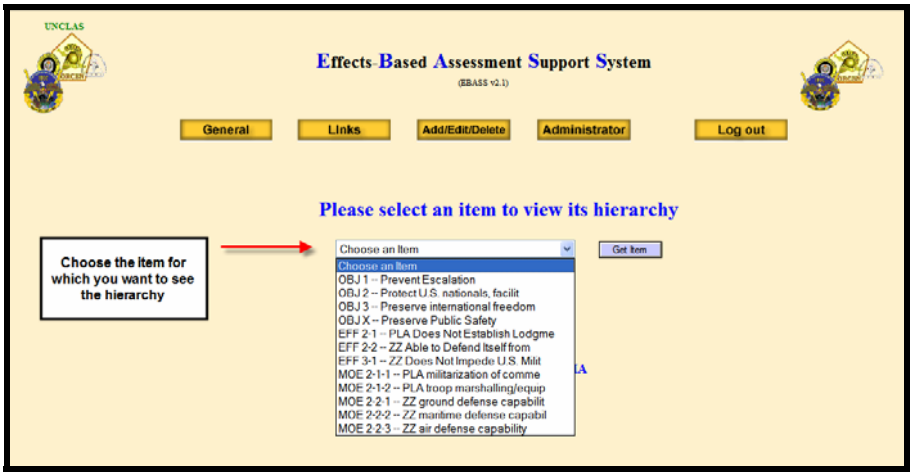


Figure 5-3. Initial Screen for the Admin Page

Once an item is selected from the drop-down list, the complete hierarchy for that item is displayed. Figure 5-4 below shows the results from an item being selected.

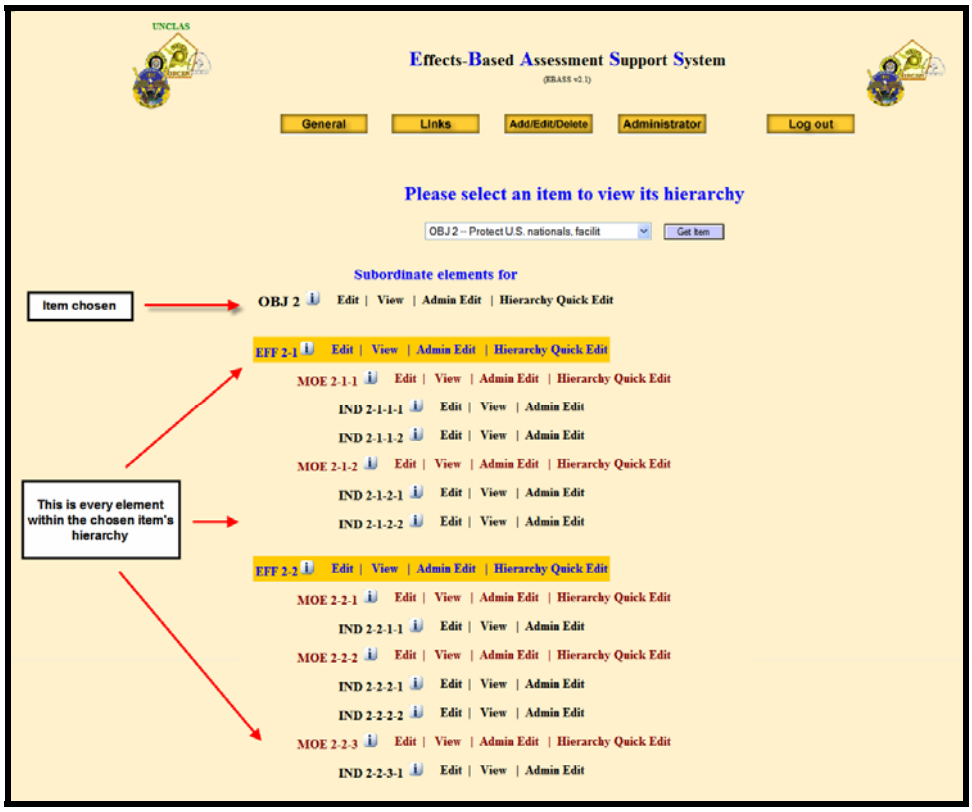


Figure 5-4. Display of Chosen Item's Hierarchy

Figure 5-5 explains the various links available to the user on the hierarchy page.

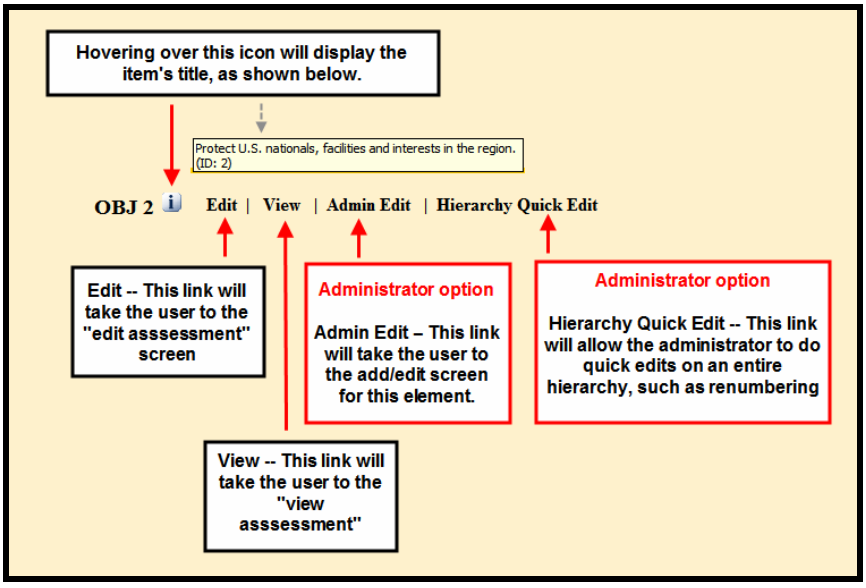


Figure 5-5. Hierarchy Page Link Menu

The hierarchy quick edit link is a quick way to rename elements within the hierarchy of an element. This is helpful if an element's short title needs to be changed along with all of its subordinate elements. For example, if an effect's short title is renamed from EFF 1-1 to EFF 1-2, then each of its children also probably need to have their short titles renamed. Figure 5-6 illustrates the hierarchy edit page.

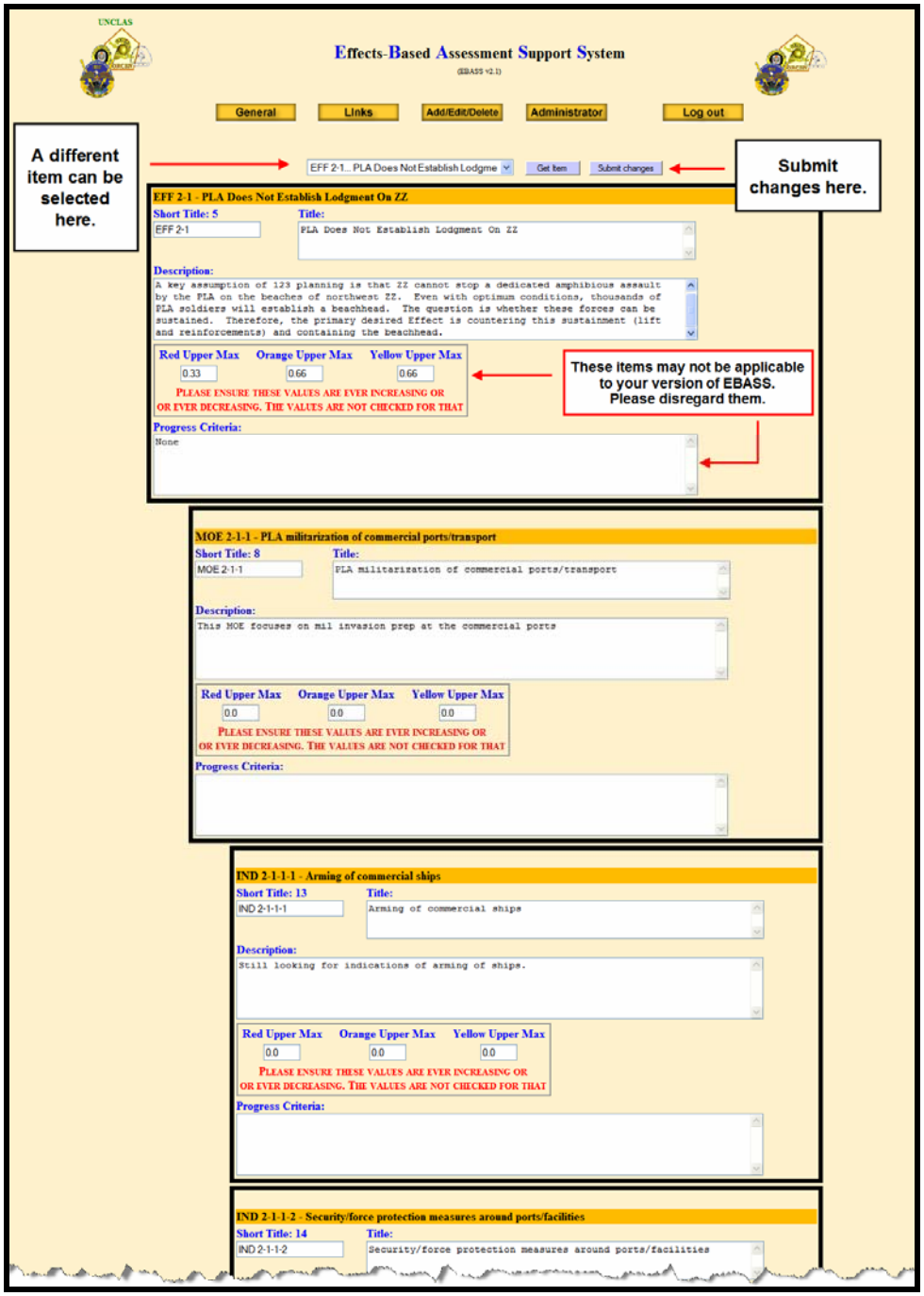


Figure 5-6. Hierarchy Edit Page

Administrator

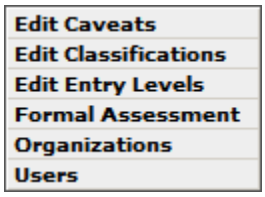


Figure 5-7. Administrator Menu

✧*Note: The current version of EBASS does NOT allow removal of caveats, classifications, entry levels, organizations, or users.*

Edit Caveats: A caveat is the additional notation associated with a classification. It normal indicates to whom classified information can be released. Many commands have their own caveats, therefore, caveats may be edited accordingly. Caveats already entered into the system can be updated by editing the precedence, caveat name, and abbreviation as necessary. Pressing the "Submit Changes" button will save the updates. Adding a caveat is done by entering the new information then pressing the "add new" button. Figure 3-1Figure 5-8 provides further explanation of the Update / Add Caveats screen.

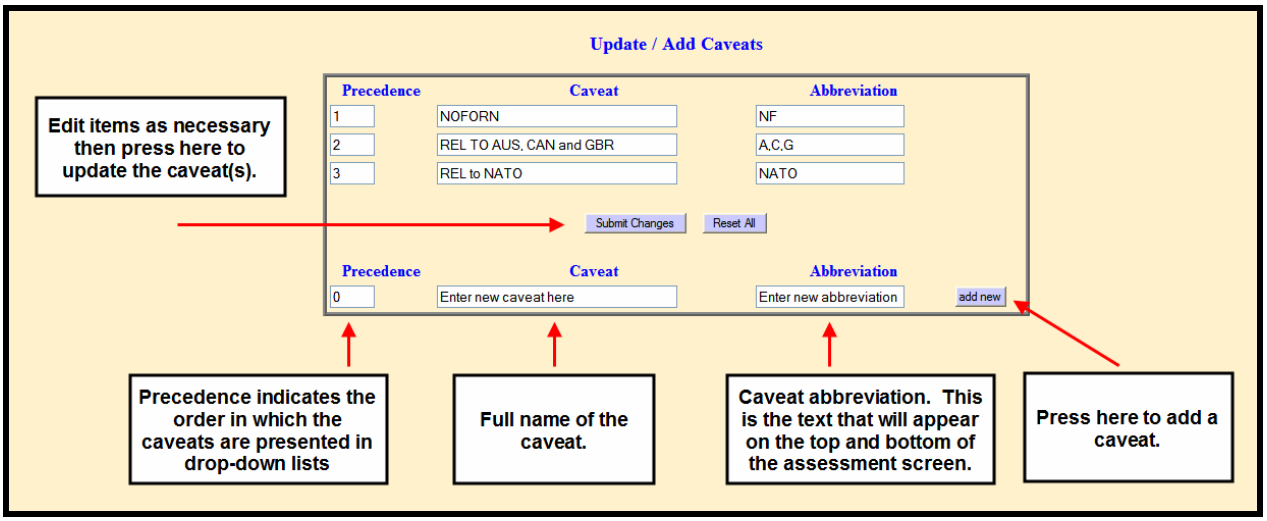


Figure 5-8. Update/Add a Caveat

Edit Classifications: This option allows the user to edit previously entered classifications or add a new one. The process to add or edit a classification is much like the process used for caveats above. However, there are two differences. The first difference is that the precedence value for classifications is not only used for sorting, it is used to signify the level of classification from lowest to highest. The second difference is that classifications have a color associated with them. The color must be selected from the drop-down list presented on the screen. Figure 5-9 provides further information regarding the updating and adding of classifications.

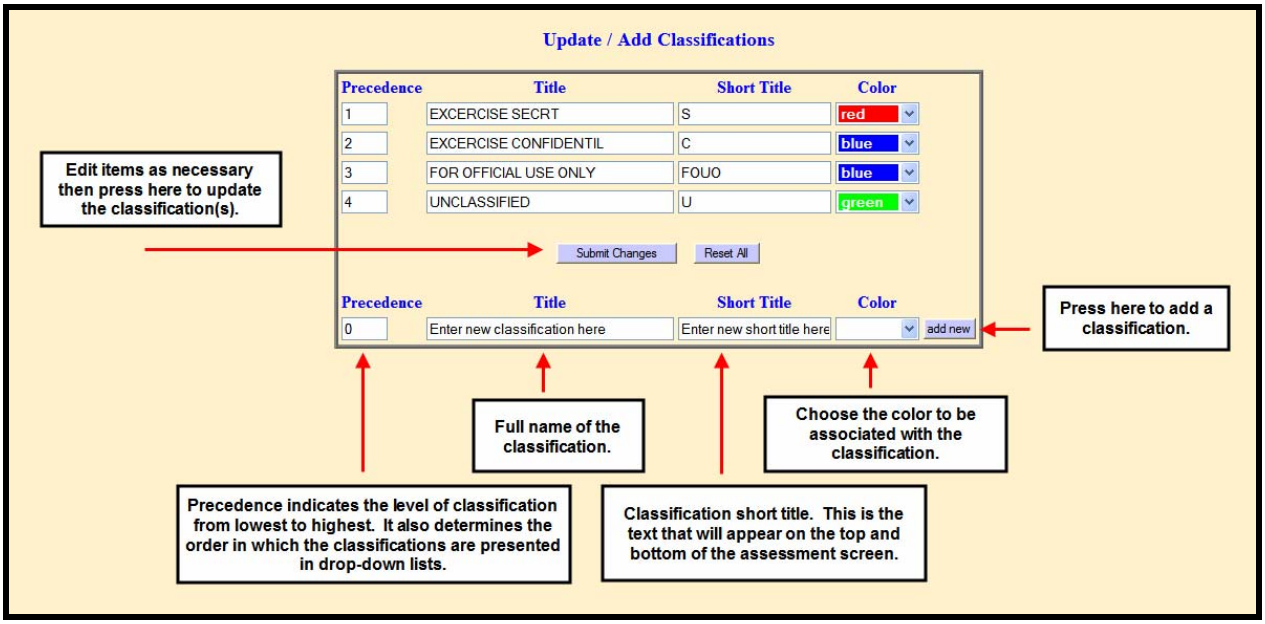


Figure 5-9. Update/Add a Classification)

Edit Entry Levels: This menu option, though present in the current menu system, should be disregarded and should not be used.

Formal Assessment: This option allows the EBASS administrator to formalize an assessment. Formalizing an assessment means to take a snapshot of all the data in EBASS and create an additional history item in the database. Once an assessment has been formalized, it cannot be edited, removed, or undone. Additionally, it is important to note that ALL elements within the database will be formalized.

The screen that appears when this option is selected is shown in Figure 5-10. The date for the formal assessment is the first entry to be made. This entry should be the end-date of the assessment period. For example, today's date is 3 April 2006. A formal assessment is to be done but the desired date for the formal assessment is 1 April 2006. The first entry would then be completed to reflect 1 April 2006 by selecting the appropriate values from the drop-down lists. The date of the new assessment is normally the same day or one day later but can be any date equal to, or greater than, the date entered as the formal assessment date.

The formalized assessment may take a minute or two to complete. Once the screen indicates the formal assessment is done, the assessment will now appear as an entry in the history graph presented when an element is viewed. The date used for the formal assessment will be the title for the new history entry. Additionally, the "new" assessment date is used as the "Updated On" date on the assessment viewing screen. Figure 5-10 below shows the formal assessment screen for the example above along with a screen shot of how the assessment is reflected on the history graph.

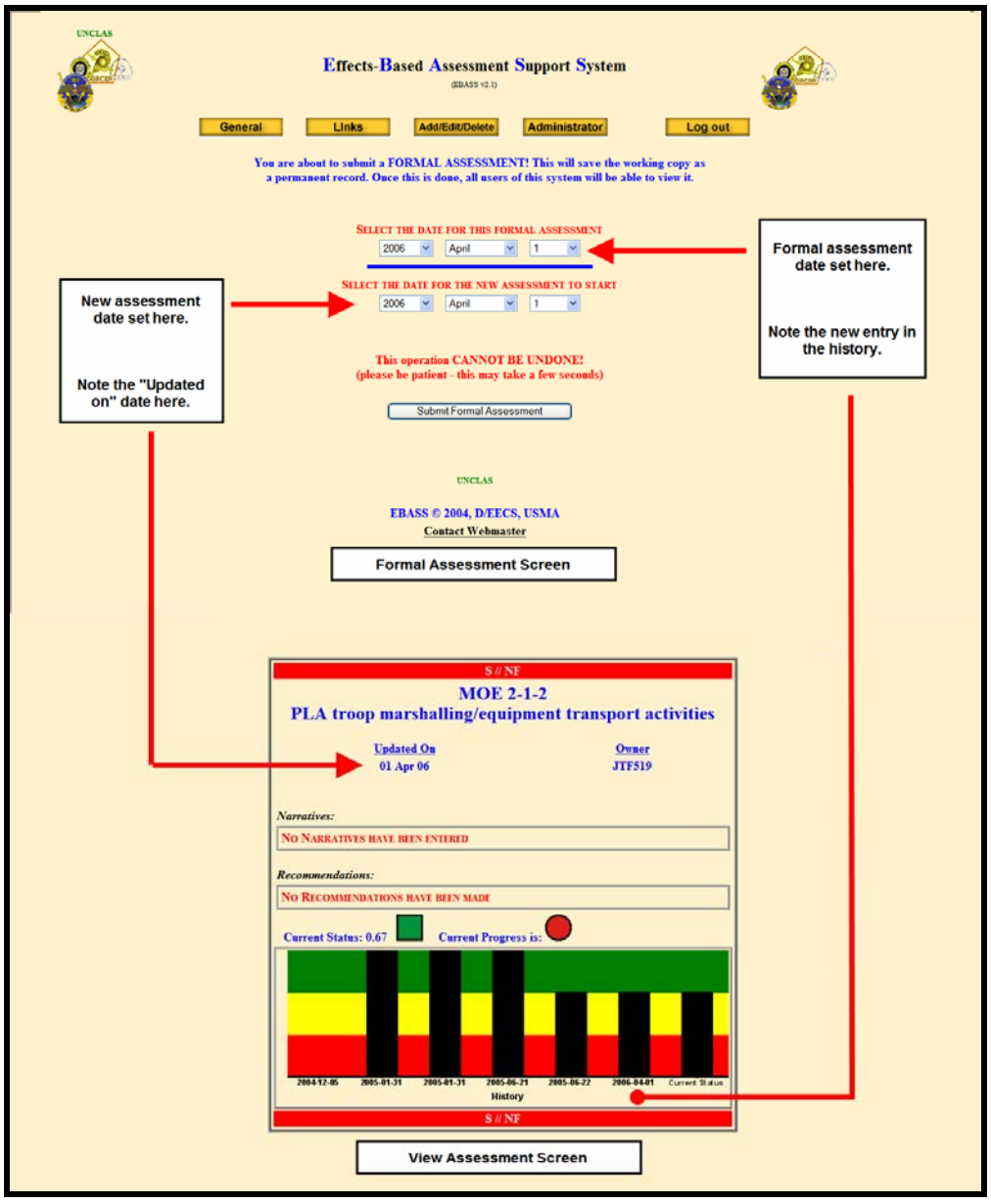


Figure 5-10. Formal Assessment Screen and Resulting History Entry

Organizations: This option allows the editing and addition of organizations within EBASS. Organizations already entered into the system can be updated by editing the short name, long name, and supervisor's user id as necessary. Pressing the "Submit Changes" button will save the updates. Adding an organization is done by entering the new information then pressing the "Add New" button. Figure 3-1 provides further explanation of the Update/Add Organizations screen.

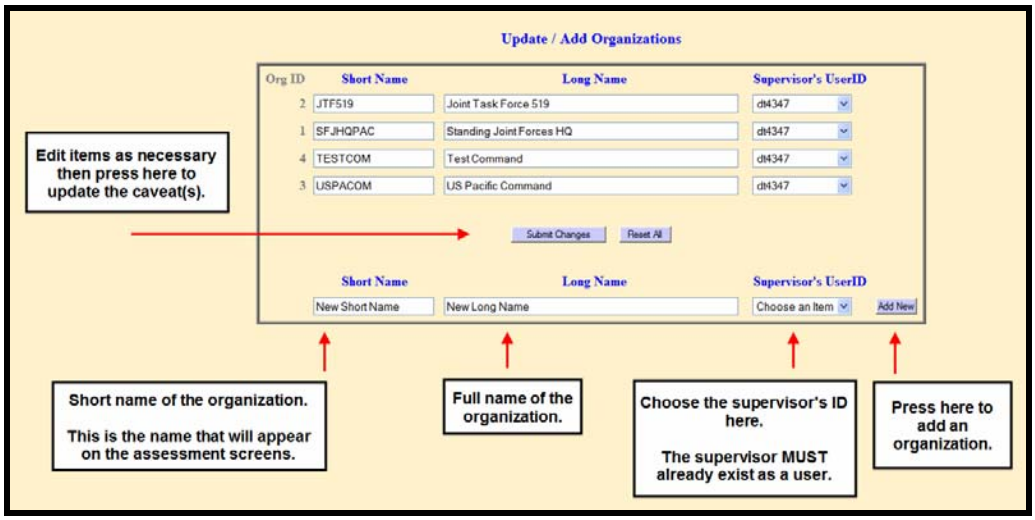


Figure 5-11. Update/Add an Organization

Users: This option allows the editing and addition of users within EBASS. Users already entered into the system can be updated by editing the information as necessary. Adding a user is done by selecting "Choose an Item" in the drop-down list and pressing the "Get Item" button. The new user's information can then be entered. Once the data is entered, press the "Add User" button. Figure 5-12 provides further details about adding or updating a user. Note that when a user's information is edited, the password box appears empty. This means that the password needs to be reset each time the user is updated. Ensure you notify the user of any changes made and inform them that their password has changed.

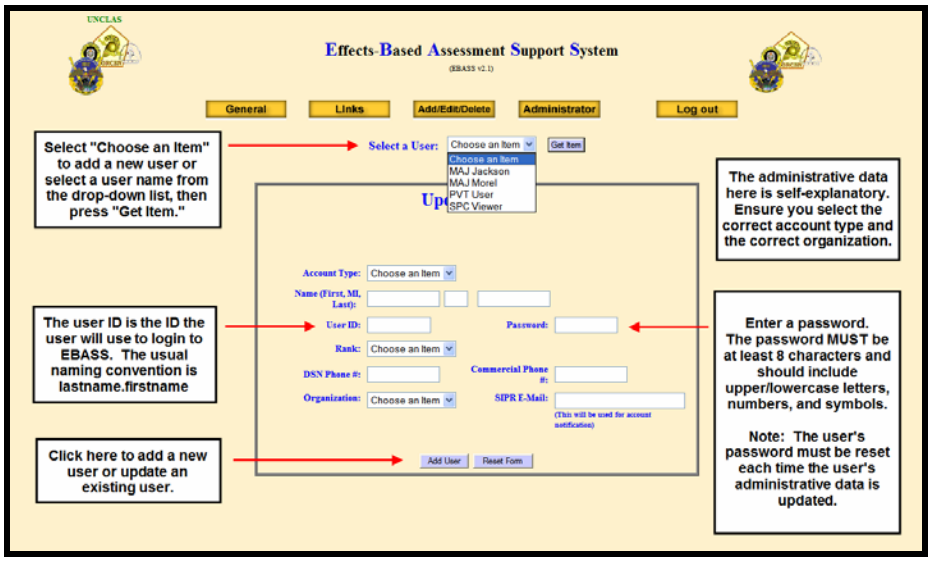


Figure 5-12. Add/Update a User

Chapter 6 Creating Elements (Administrator Only)

This chapter discusses actions that can only be performed by a system administrator.

The EBASS Hierarchy

The hierarchy of elements within EBASS is illustrated in Figure 6-1 below. The root of the hierarchy is an objective (OBJ). An OBJ can only have effects (EFF) as children. An EFF in turn, can only have measures of effectiveness (MOE) as children. Lastly, an MOE will have at least one indicator (IND) as a child. The following paragraphs will illustrate the creation of these elements from the top down.

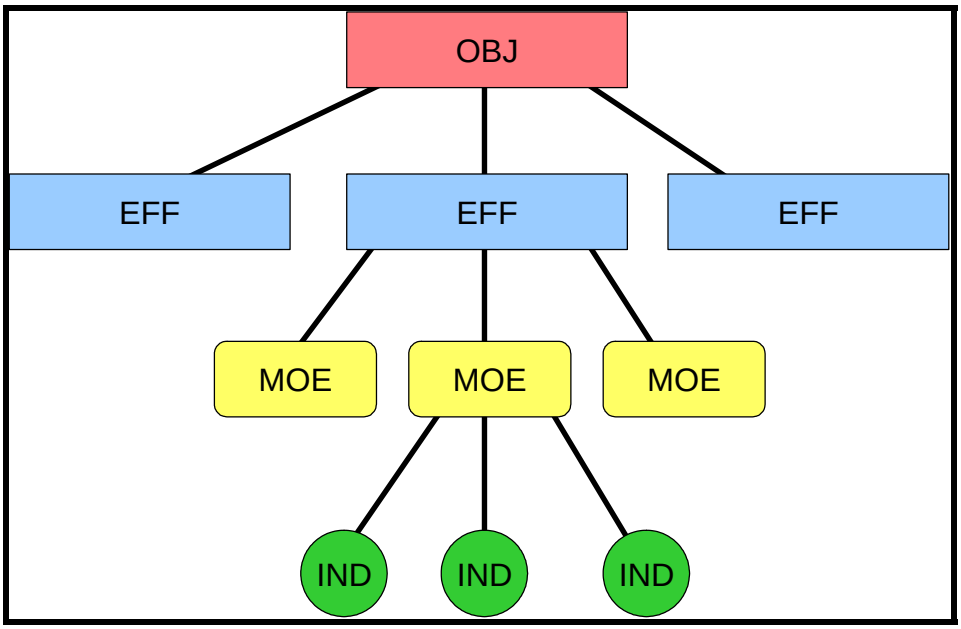


Figure 6-1. EBASS Elements Hierarchy

Short Title Naming Convention

Each element within the hierarchy will need a short title assigned to it. As the EBASS Administrator, you should define and strictly adhere to a naming convention for the short titles. The short title is used extensively in the sorting and ordering of the elements when they are presented on the screen. A naming convention also aids users in selecting and reviewing related elements. For these reasons, some time should be spent developing your naming convention.

The most often used convention is to use the abbreviations OBJ, EFF, MOE, and IND followed by a single space, followed by a number and a dash for each level going down the hierarchy. As an example, the following table illustrates short titles that may be used for related elements from OBJ to IND. This is merely an example; you may choose whatever convention you desire.

Table 6.1 Sample Naming Convention

Short Title	Description
OBJ 1	Objective
EFF 1-1	First EFF under OBJ 1
EFF 1-2	Second EFF under OBJ 1
MOE 1-1-1	First MOE under EFF 1-1
MOE 1-1-2	Second MOE under EFF1-1
IND 1-1-2-1	First IND under MOE 1-1-2
IND 1-1-2-2	Second IND under MOE 1-1-2

Create an Objective, Effect, or MOE

The creation of an objective, effect, or an MOE is exactly the same. The following guidance can be applied no matter which of the three is to be created. The only differences between the three are as follows:

1. **Entry Type**: A drop-down list is presented on the screen which will allow the entry type to be chosen (OBJ, EFF, or MOE). Ensure the appropriate entry type for the element to be created is properly selected.

2. **Subordinate Element Links**: The bottom of the edit screen contains the links to the element's children. The drop-down list in this area will be populated according to the element being created. For example, if an objective is being created, only effects will appear in the drop-down list. If an effect is being created, only MOEs will appear in the drop-down list, etc.

Creation of any element within EBASS is started by pressing the "Add/Edit/Delete" button on the main menu at the top of the screen. Hovering over the menu will produce a submenu; select "Effects and MOEs" from the submenu. The opening edit screen appears once the selection is made. Figure 6-2 below provides guidance on completing the edit screen. Be sure to pay particular attention to the entry type, owner, and short title.

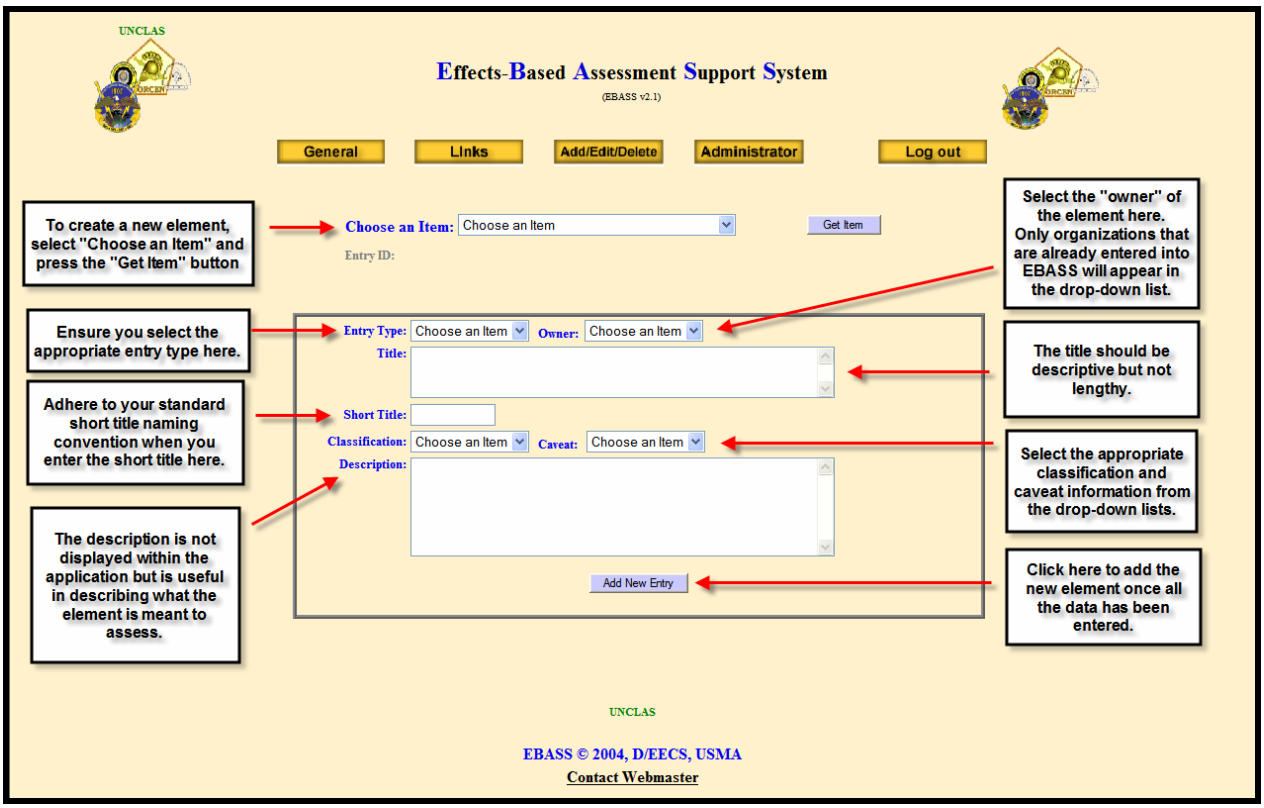


Figure 6-2. Initial Screen to Create an Objective, Effect, or MOE

Add Child Links

Once the data has been entered and the "Add Entry" button has been pressed, the following screen will appear (Figure 6-3). Note there are no subordinate elements (children) linked yet. Figure 6-3 below shows the drop-down list that will normally appear if subordinate elements have been previously entered. If no subordinate elements have been created yet, i.e. the database has not yet been populated, the drop-down list will be empty. For illustration purposes, we will assume that subordinate elements have already been added to the database. Figure 6-4 illustrates how to select, add, and modify the weight for a child element.

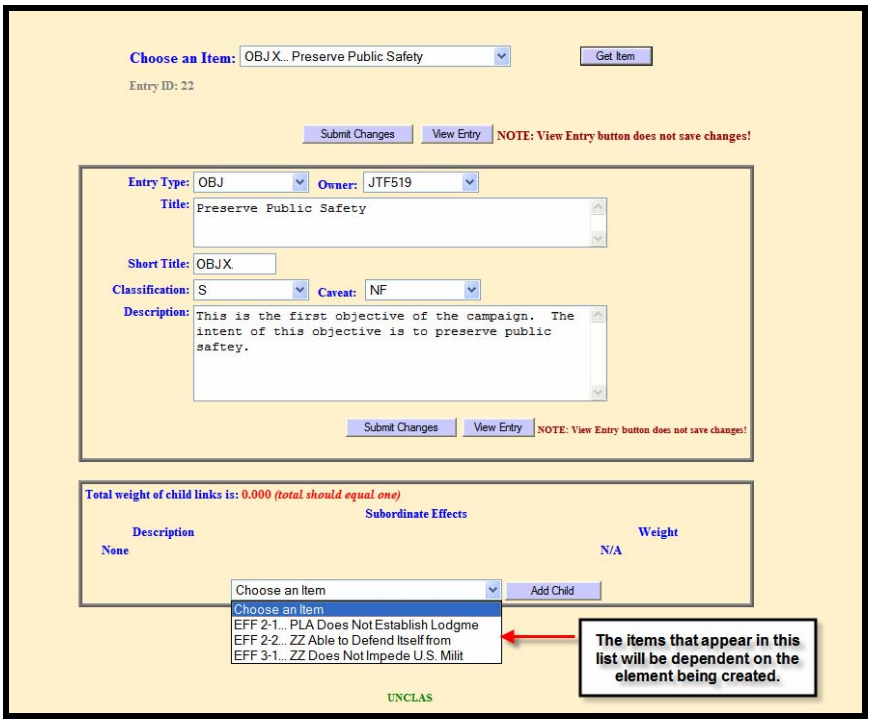


Figure 6-3. Initial Screen After Adding an Element

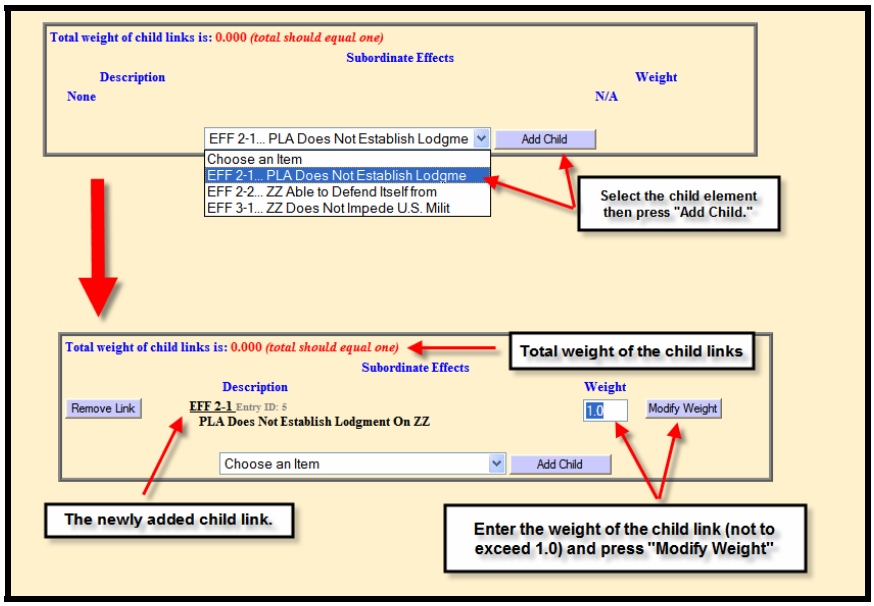


Figure 6-4. Adding a Child Link

Additional child links are added by repeating the steps above.

It should be noted that although the total of the weights cannot exceed 1.0, they can, in fact, be less than 1.0. If the weight total is less than 1.0, the actual weight used for each

link in calculating the assessed value will be each link's weight, relative to the total weight. For example, assume there are two child links; child one having a weight of 0.4 and child two having a weight of 0.2. The total weight of the two children is 0.6 (0.4 + 0.2). Therefore, when calculating the assessed value, child one will have a weight of 0.667 (0.4 / 0.6) and child two will have a weight of 0.333 (0.2 / 0.6).

Figure 6-5 below is the initial view of an element once it has been created.

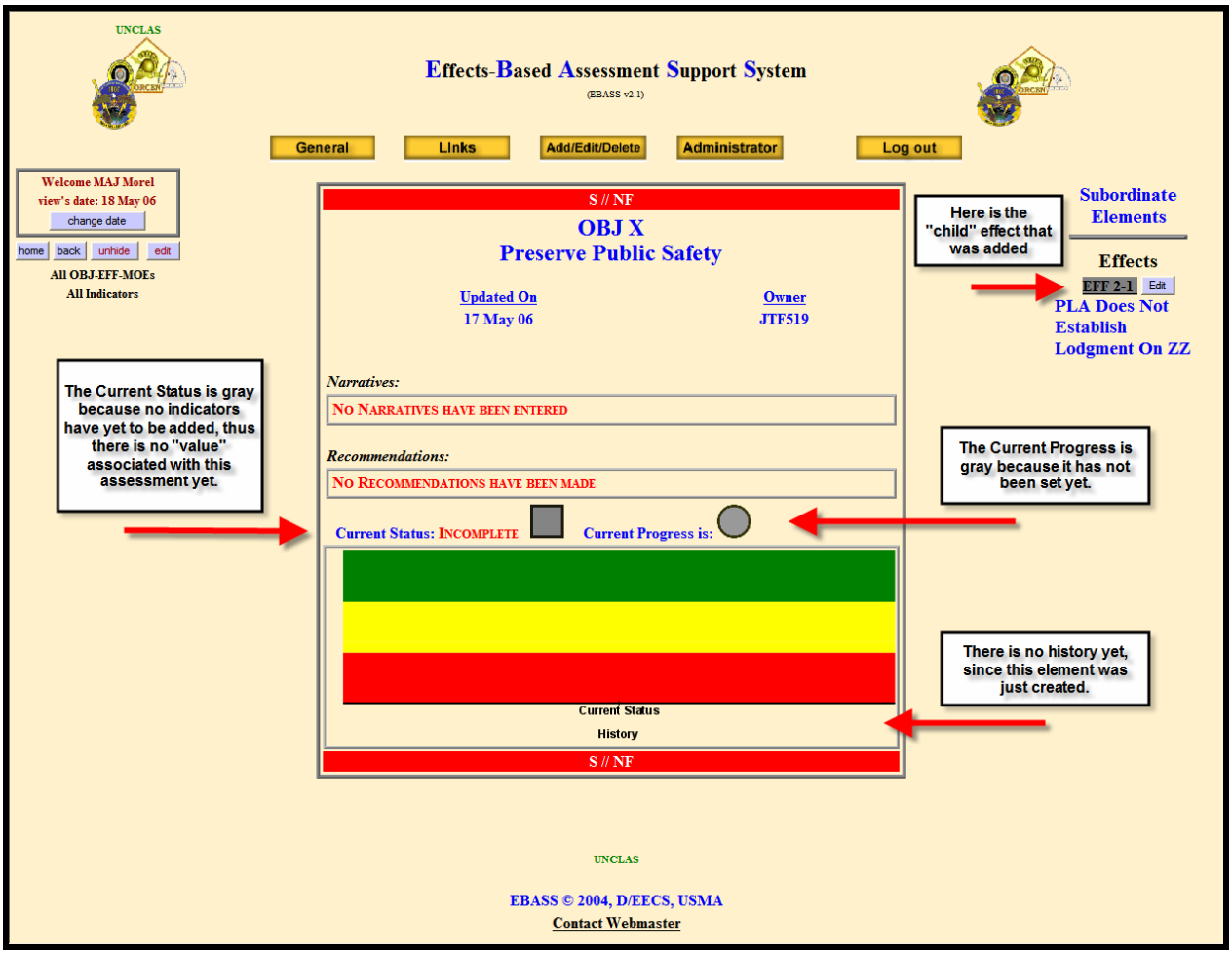


Figure 6-5. View of an Element After Creating It

Create an Indicator

Just like the creation of an objective, effect, or MOE, creation of an indicator is started by pressing the "Add/Edit/Delete" button on the main menu at the top of the screen. Hovering over the menu will produce a submenu; select "Indicators" from the submenu. The opening edit screen appears once the selection is made (Figure 6-6).

Complete the administrative-type data for the indicator much like was done for the objectives, effects, and MOEs. Adhere to your naming convention for the short title. We

now need to decide what scale type the indicator will have. Unlike other elements in the EBASS hierarchy, indicators allow the user to input actual metric data. There are two ways a user can input the data: numeric input or from a drop-down list. The type of input is determined by the scale type.

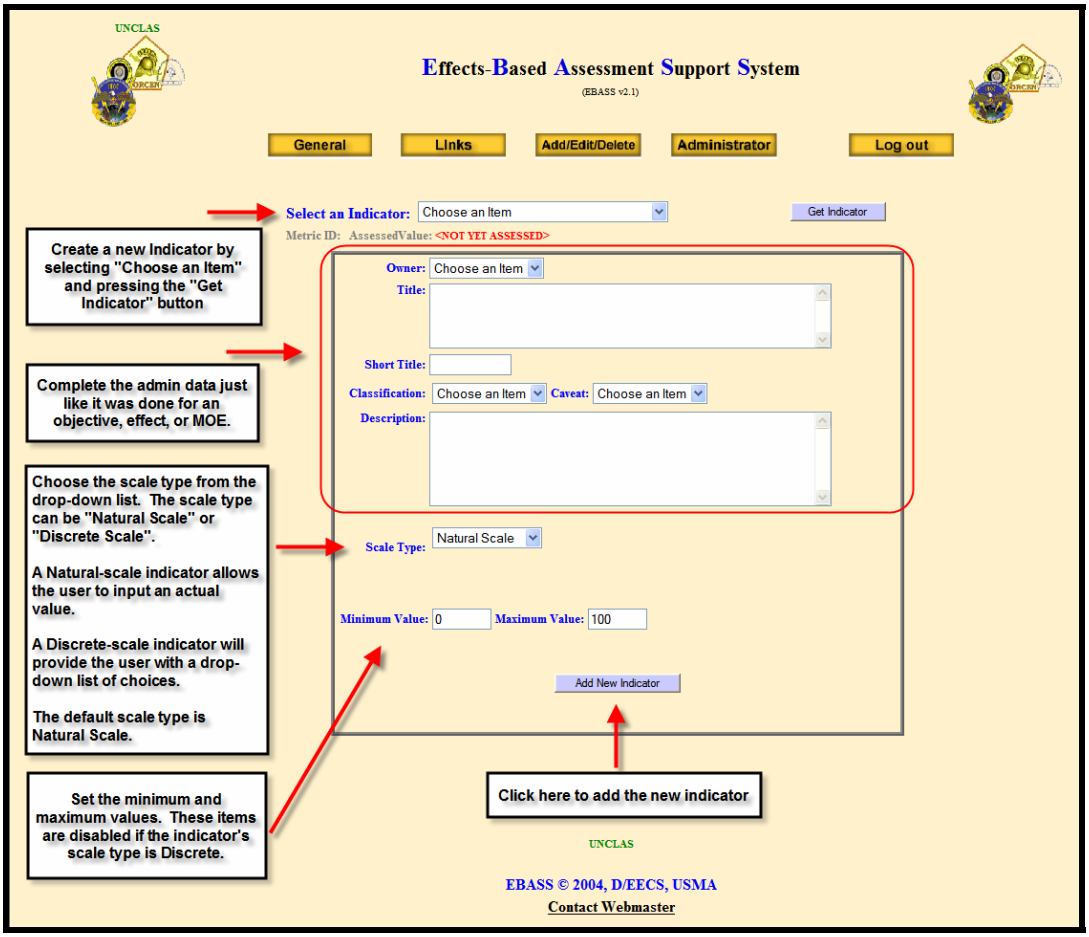


Figure 6-6. Opening Edit Screen

Scale Types. There are two types of scales for an indicator: Natural and Discrete.

Natural Scale

Natural-scale indicators have actual values as inputs, such as 50, 3.7 or 0. For example, the value could represent the percentage of combat-ready vehicles within a unit or the number of personnel being detained. The edit screen for a natural-scale indicator provides an input area for the raw value and also shows the minimum and maximum values that can be entered. (Figure 4-8) The number input is then normalized to a value between 0 and 1.0, resulting in the assessed value. The normalized value is derived from the indicator's graph. The details of how to create the graph are discussed next.

Figure 6-7 below illustrates the editing screen for the graph of a natural-scale indicator. The curve on the graph represents the function that will be applied to the raw input value to obtain the assessed value. The y-axis scale values start at 0 and continue to 1.0. This value represents the assessed value that will be returned by the function, given the user's raw value input. The scale along the x-axis represents the raw value input by the user. The x-axis scale starts with the minimum value and continues to the maximum value for the indicator, as established when the indicator was created.

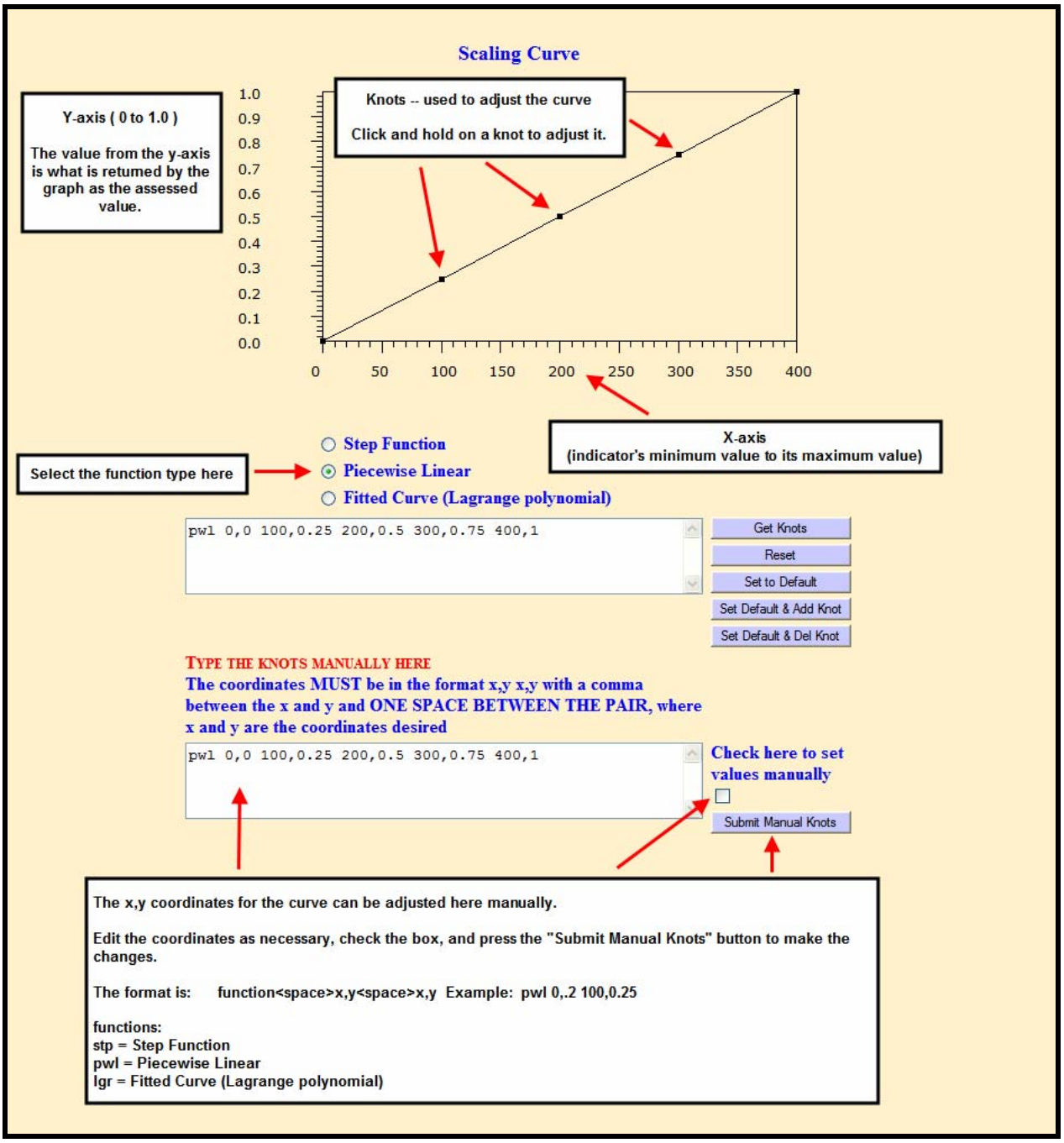


Figure 6-7. Editing a Natural-Scale Graph

A small submenu used to help in the editing of the curve is located near the X, Y coordinate box. The submenu is explained in Figure 6-8 below.

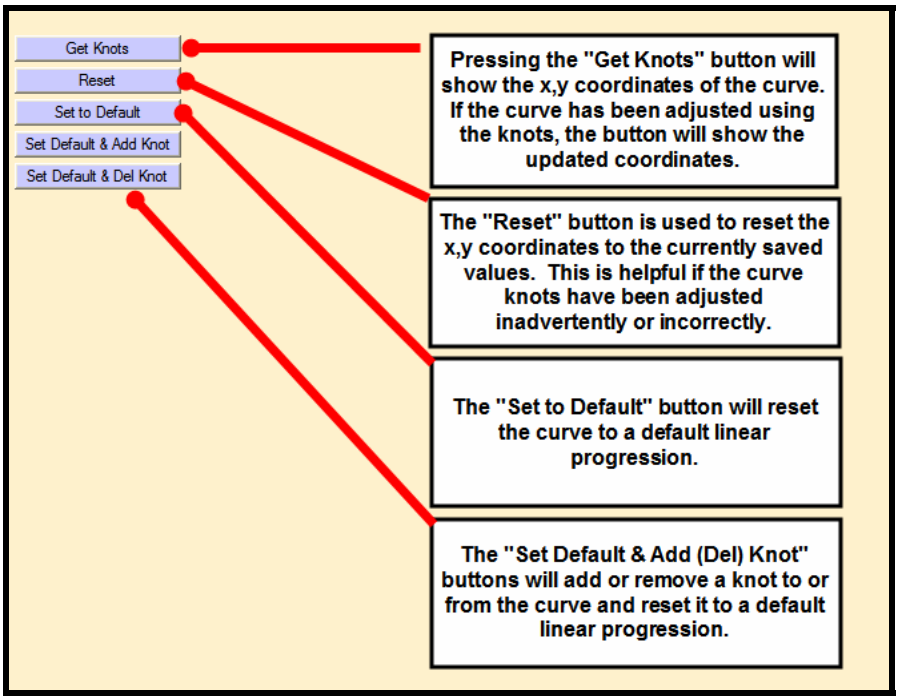


Figure 6-8. Submenu for X, Y Coordinate Editing

There are three types of curves that can be used: Step Function, Piecewise Linear, and Fitted Curve (Lagrange polynomial). The type of curve used is up to you as the administrator. A particular curve may model your function better than another.
A sample function, modeled by all three curve types, is shown in Figure 6-9.

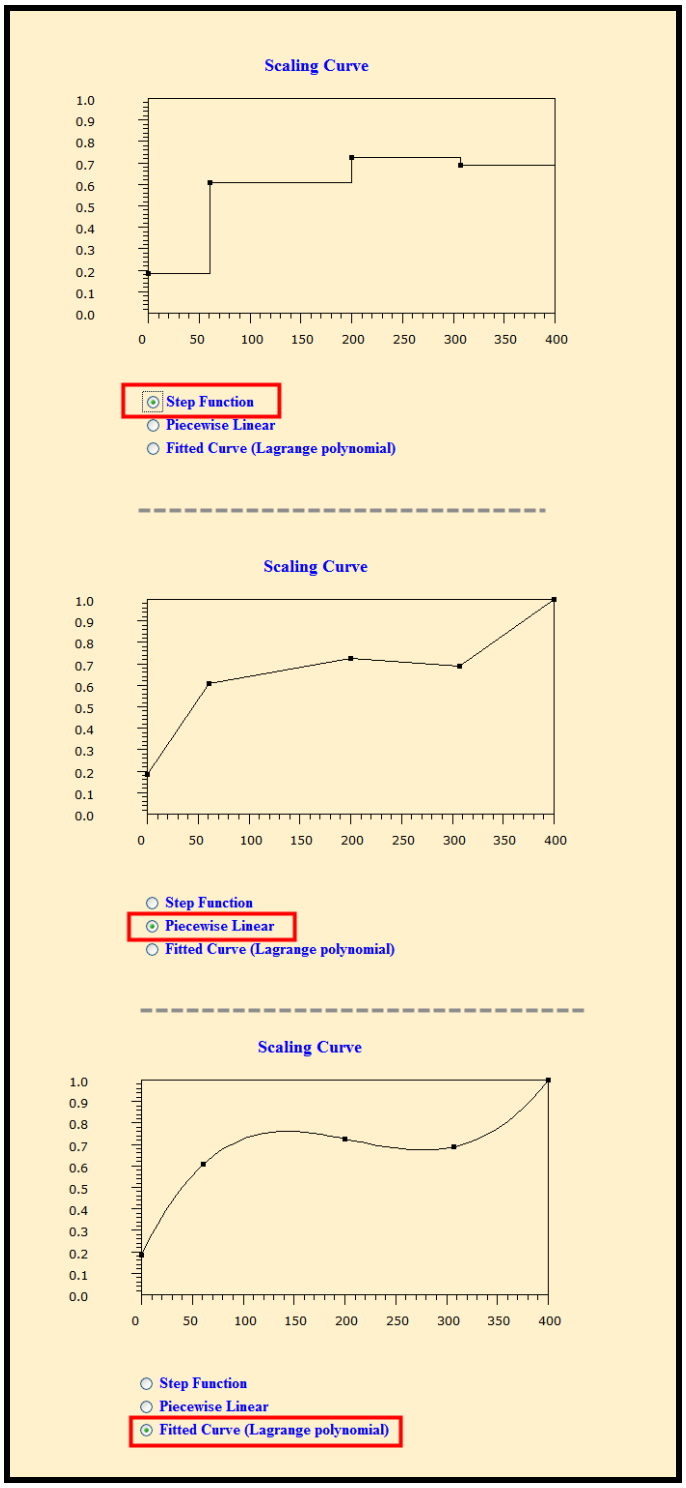


Figure 6-9. Sample Function Plotted on all Three Types of Curves

The assessed value returned by the graph is the value along the y-axis where the raw value along the x-axis intersects with the curve on the graph. Figure 6-10 illustrates this correlation.

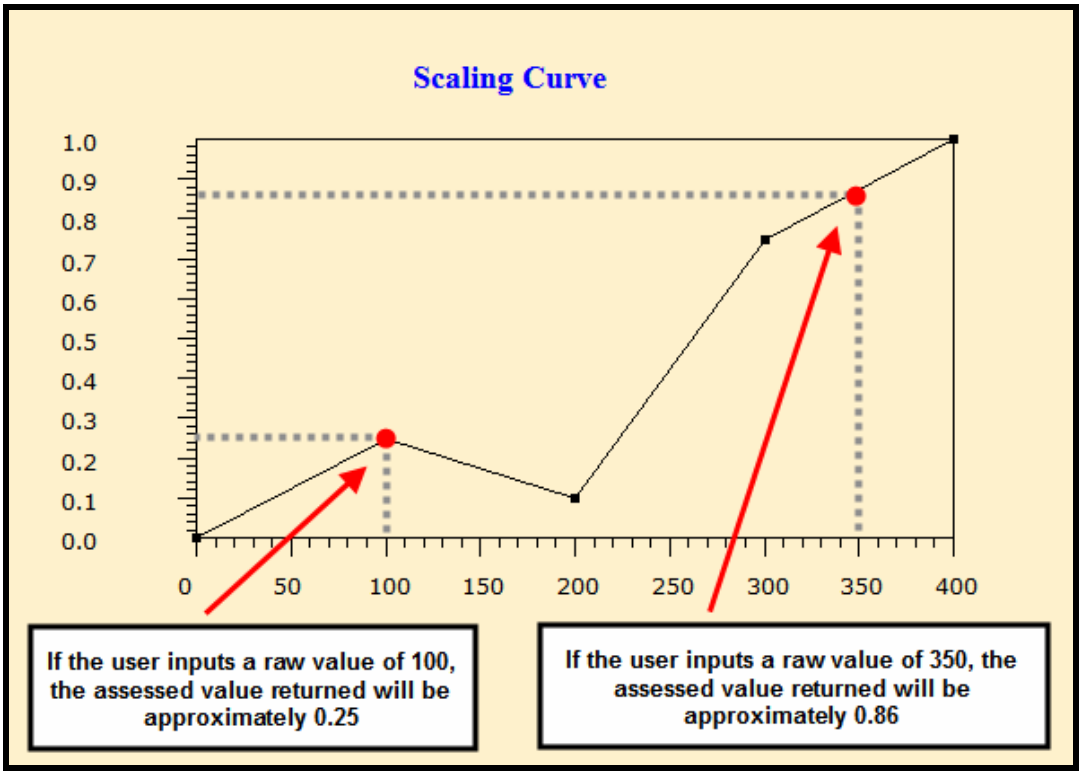


Figure 6-10. Assessed Value Curve Example

The graph for a natural-scale indicator can be adjusted in two ways. The first way is to click-and-hold one of the "knots" (small black squares) on the curve. Move the knot to the desired position and release. The other knots can be adjusted in the same manner until the curve matches the desired pattern. The curve can easily be adjusted this way; however, moving the knots to a very specific location can be difficult. Manually inputting the x, y coordinates, the second way of adjusting the knots, is much more accurate.

The second way to adjust the curve is to manually edit the x, y coordinates. There are two boxes on the screen that show the coordinates (Figure 6-11). The top box shows the current coordinates. The bottom box initially shows the current coordinates, but the coordinates can be edited in this box. Read the instructions on the screen just above the box. It is VERY important that the coordinates be typed exactly as described. Once the coordinates have been edited, check the "Check here to set values manually" box then press the "Submit Manual Knots" button to submit your changes. Figure 6-11 below illustrates the manual editing of the coordinates. ✧*Note: the current version of EBASS does NOT check for errors within the coordinates. If an error screen appears when the coordinates are submitted, press the back button on the browser and try again.)*

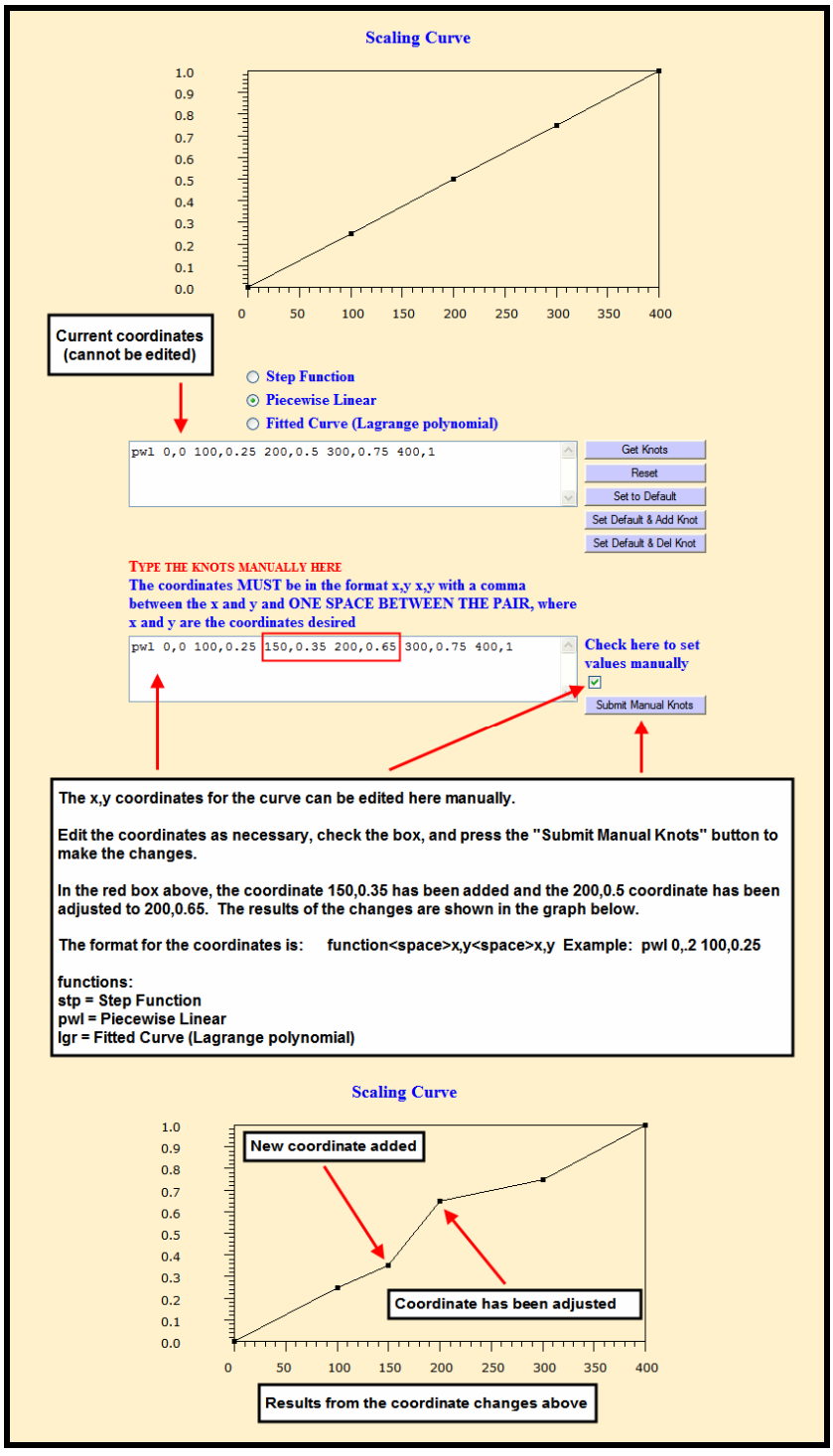


Figure 6-11. Manually Editing Coordinates

Discrete Scale

Discrete-scale indicators provide the user with a drop-down list to enter the value rather than entering an actual number. For example, in Figure 6-12, the user has the option of choosing "Low", "Med", or "High." The assessed value given to this indicator is the scale value associated with the choice the user makes from the drop-down list. In the drop-down list below, if the user selects "Low", the assessed value will be 0.99. If the user selects "Med", the assessed value will be 0.66, and finally, if the user selects "High", the assessed value will be 0.33. It should be noted that in this example, choosing "Low" is a good thing. The edit screen that corresponds to this example is shown in Figure 6-13 below.

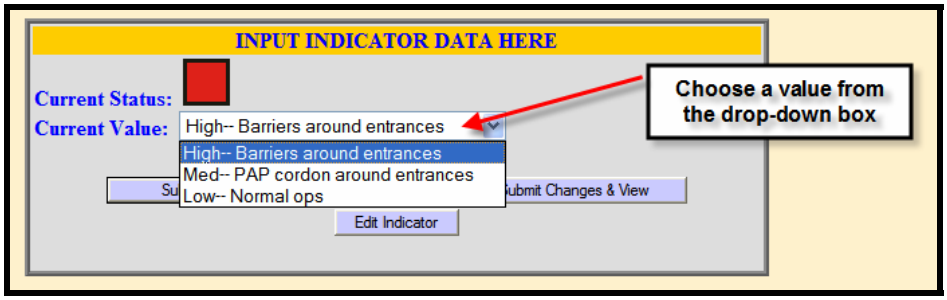


Figure 6-12. Sample Drop-Down List for a Discrete-Scale Indicator

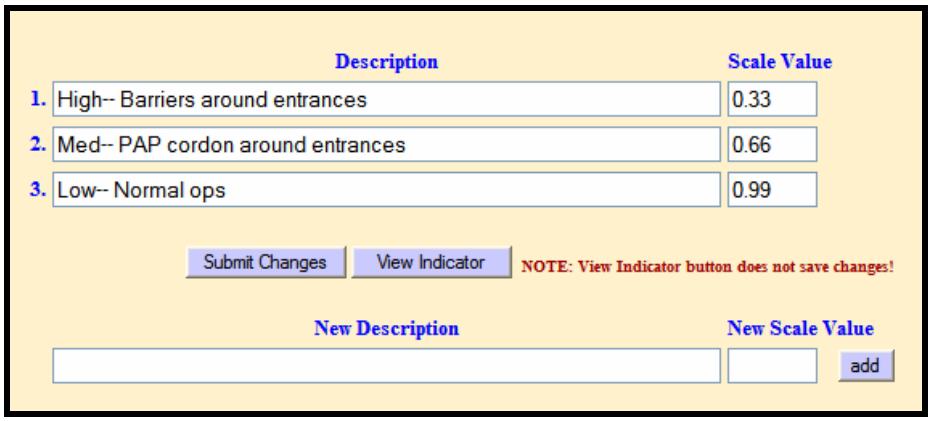


Figure 6-13. Edit Screen for Example in Figure 6-12

Like a natural-scale indicator, the assessed value is derived from criteria set forth when the indicator is entered into the system. However, the assessed value isn't derived from a graph or curve, it is entered when the scale items are added. Figure 6-14 below is the editing screen that appears once a discrete-scale indicator is created. Notice there are no scale items yet but there is an area at the bottom to add new scale items. Enter the information requested, then press the "add" button to save the new scale item. Figure 6-15 shows the results of adding a scale item and the start of entering another. Figure 6-16 is the drop-down list the user would see as a result of the scale items added in Figure 6-15.

Previously entered scale items can be changed by editing the description and/or scale value then pressing the "Submit Changes" button. There is no limit to the number

of scale items that can be added. ✧*Note: the current version of EBASS does not allow the deletion of a scale item.*

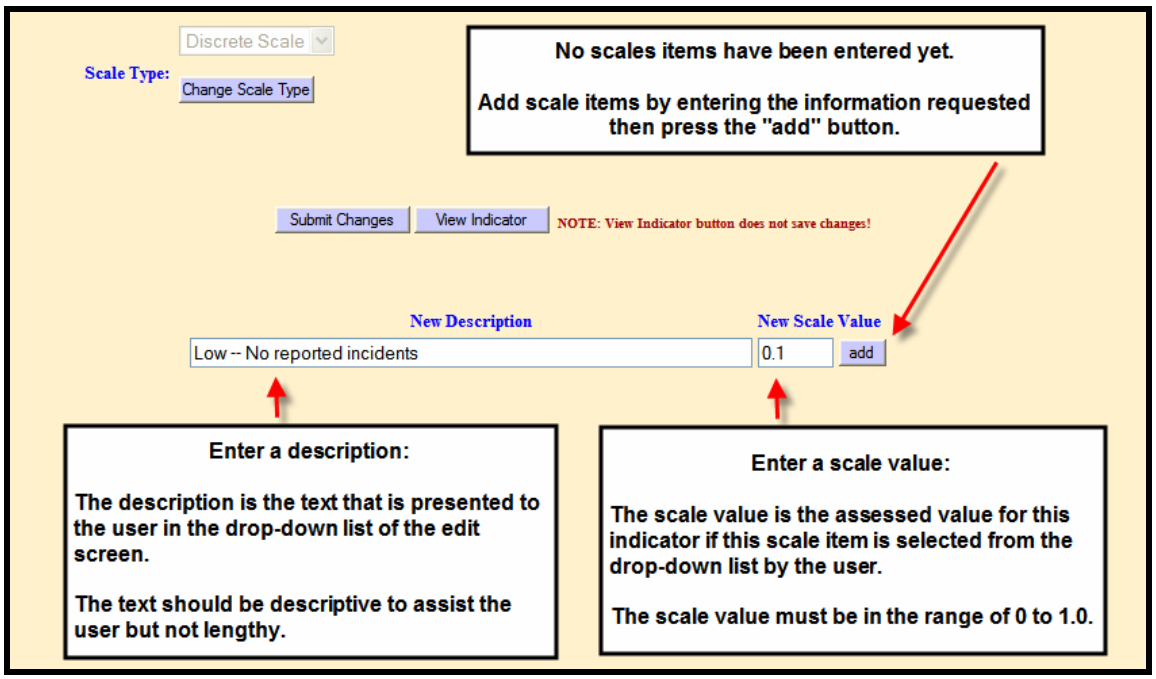


Figure 6-14. Adding a New Scale Item

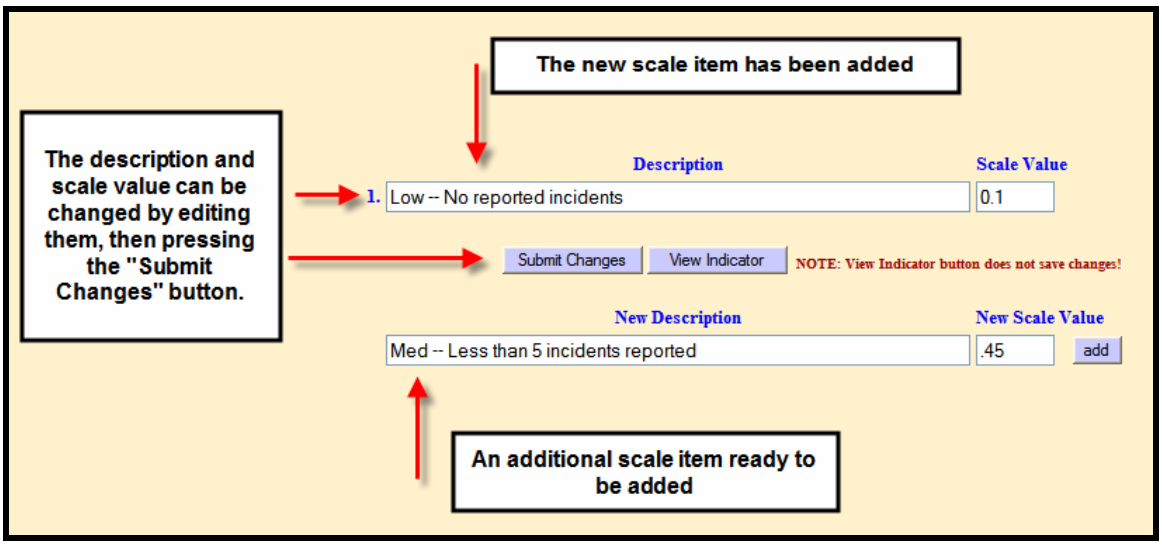


Figure 6-15. A New Scale Item has been Added

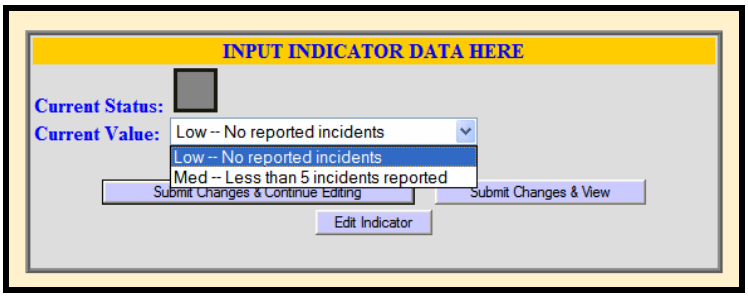


Figure 6-16. Drop-Down List Created as a Result Adding Scale Items

Appendix C: EBASS Software Development

This appendix provides a series of diagrams to illustrate the basic software package and database structure used for the implementation of EBASS. Figure C.1 is a diagram which provides a visual depiction of the EBASS software architecture. This is the general structure of the software components of the tool and their relationship to each other.

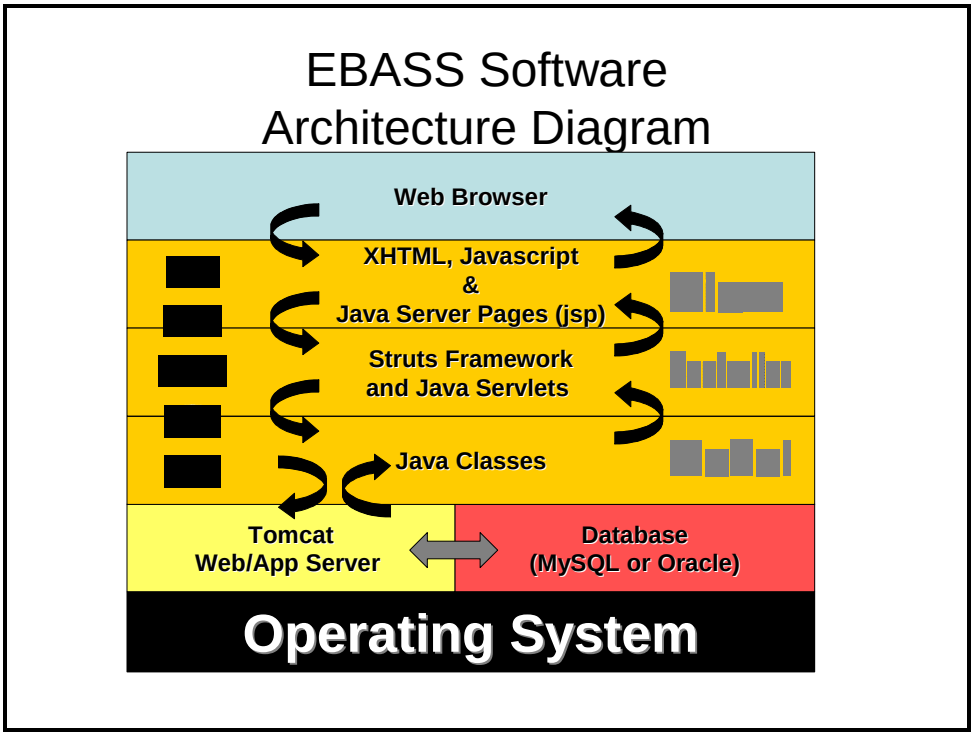


Figure C.1. EBASS Software Architecture Diagram

Figure C.2 is table relationship diagram for the EBASS database. This is diagram provides a visual depiction of the tables, the elements within each table, and the reference relationships between each table. This diagram is useful in allowing user to understand the types of data stored and how the data elements relate to each another.

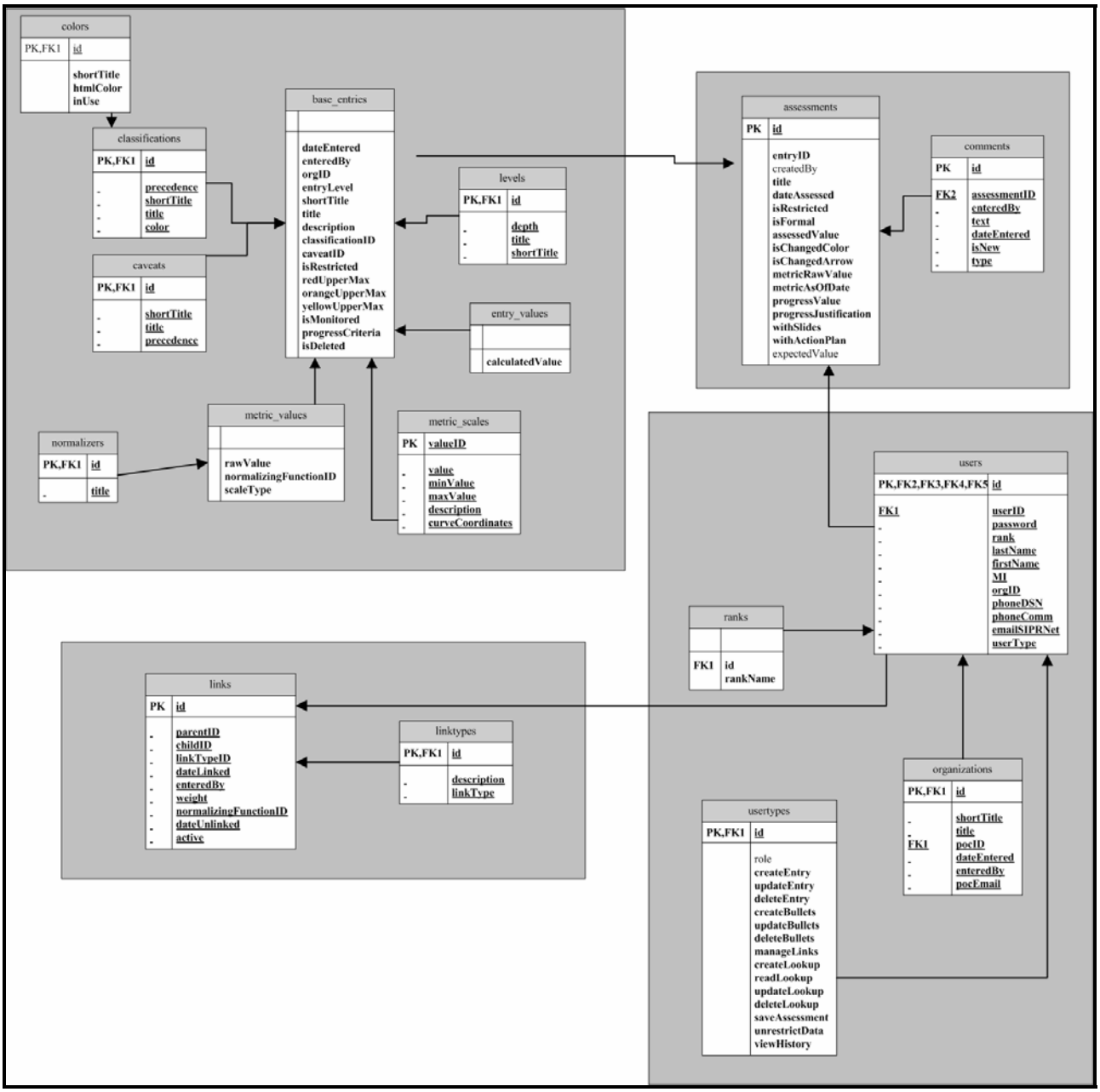


Figure C.2. EBASS Database Relationship Diagram

Appendix D: Defining Appropriate Metrics

"The victorious army first realizes the conditions for victory, and then seeks to engage in battle. The vanquished army fights first and then seeks victory."

--Sun Tsu, *The Art of War*

D.1. Executive Summary

Without clear objectives, it is oftentimes difficult to make good decisions. To come up with clear objectives, organizations must first determine what is important and then figure out a way to assess and evaluate how well they are able to perform with respect to what is important (United States Military Academy, 2004). As the familiar saying goes, "What gets measured, gets done." Metrics, therefore, play a critical role in organizational performance, and leaders today are very concerned about exactly what is measured (Frost, B., 2000). Regardless of the type, size, or function of the organization, good metrics help to drive systemic improvement and are usually (Brown, M., 1996):

- Few in number to allow concentration on those vital key variables
- Linked to key business drivers to promote organizational success
- Composed of a mix of past, present, and future to achieve a holistic perspective
- Based around needs of customers, shareholders, and key stakeholders
- Driven from the top and permeated throughout all levels of the organization
- Composed of multiple indices to give a better overall assessment
- Flexible and adaptable to changes in environment and strategy
- Based on targets or goals established through research rather than arbitrary numbers

Most organizations spend countless hours collecting and interpreting data intended to enhance business performance and productivity. Yet a large portion of this time amounts to nothing more than wasted effort when the wrong measurements are analyzed. As a result, organizations tend to create unnecessary procedures, squander resources, and detract from their objectives when this happens. Of greater consequence, however, is that wrong metrics oftentimes lead organizations to inaccurate decision-making which, in turn, translates into poor choices.

This section of the paper examines how organizations can ensure that they are focused on a set of appropriate metrics that are linked to critical success factors, such as:

- Reduced risk and improved safety
- Improved operational efficiency and effectiveness
- Increased savings in personnel training costs
- Improved stakeholder satisfaction
- Better relations with key populations within an area of interest
- Enhanced command and control
- Improved intelligence capabilities that are more reliable, timely, and accurate
- Increased confidence in major decisions

Developing appropriate metrics for the Effects-Based Assessment Support System (EBASS) is critical not just as a means to chart progress for the military operation, but more importantly, as a means to help continuously determine how specific military actions are impacting political outcomes and decide what adjustments are needed to achieve positive end-states. A good way to help ensure that the metrics selected for EBASS are meaningful is to make sure the chosen measurements are SMART--specific, measurable, aligned, realistic, and time-bound (Moore, C., 2005).

D.2. Introduction—A Shift to More Meaningful Metrics

For every objective, there ought to be at least one quantifiable metric and a target value for that metric. Once the objective-level target for a metric has been reached, the organization knows that a particular objective has been achieved. Unfortunately, most organizations try to measure too many things, measure the wrong things, use measures that no longer have relevance, or use measures that are ambiguous and give managers and workers little control (Moore, C., 2005). When this occurs, a great deal of organizational time, energy, and resources are wasted.

Michael Dell, CEO of Dell Computers, has stated, “To motivate an employee to think like an owner, you have to give her metrics she can embrace” (Dell, M., and Fredman, C., 1999). SMART metrics—those that are specific, measurable, aligned to key objectives, realistic, and

time-bound (attainable within a certain time period)—are a key element of a performance management system that helps link employees to the success of the organization (Figure D.1).

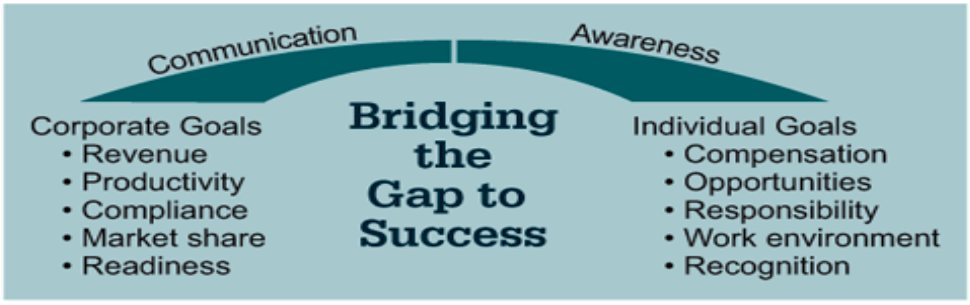


Figure D.1. Aligning Organizational and Individual Goals (Moore, C., 2005)

However, most traditional performance management systems provide "lagging" rather than "leading" indicators. They tend to be more like rearview mirrors that explain how goals were or were not met based on past performance rather than being more like steering wheels that enable organizations to adjust to changing conditions (Frost, B., 2000). In today's more measure-based, goals-driven, performance management culture, improved metrics must be developed to better align efforts, implement strategies, and focus on results (Figure D.2).

THE OLD METRICS		THE NEW METRICS
Primarily financial	.....	Multidimensional
After the fact	.....	Mid-course steering
Control and report	.....	Align effort, create value
Not actionable	.....	Line of sight to action
Earnings & taxes	.....	Implement strategy
Within functional areas	.....	Manage across functions
Manage input costs	.....	Manage output value

Figure D.2. A Shift to More Meaningful Metrics (Frost, B., 2000)

Organizations that make a concerted effort to shift to metrics that are multidimensional, permit mid-course steering, create value, display line of sight to action, enhance strategy, facilitate management across multiple functions, and assist in the management of output value are much more likely to find themselves to be the leaders in this new century. The shift to more

meaningful metrics will lead to the advancement of purposeful organizations that succeed at effectively and efficiently getting things done right. EBASS attempts to facilitate such advancements.

D.3. A Process for Linking Meaningful Metrics to Organizational Objectives for EBASS

Dr. Bob Frost has developed a three-step methodology for helping develop meaningful metrics and performance indicators (Frost, B., 2000):

- Step 1: The organization examines its business strategy and stakeholders to find crucial Performance Topics.
- Step 2: The organization determines where and how it must succeed on each topic, spelling out the where's and how's as a set of Critical Success Factors.
- Step 3: The organization considers each Critical Success Factor and defines specific Performance Indicators that will track success on it.

This three-step process works from the general to the specific—from Performance Topic to Critical Success Factors to specific Performance Indicators (Figure D.3). Taking the time to link performance indicators to performance topics helps to ensure the chosen metrics will be meaningful and provide value to the organization. Raytheon Corporation's Emery Powell perhaps summarizes it best when he stated, "A strategy without metrics is just a wish. And metrics that are not aligned with strategy are a waste of time."

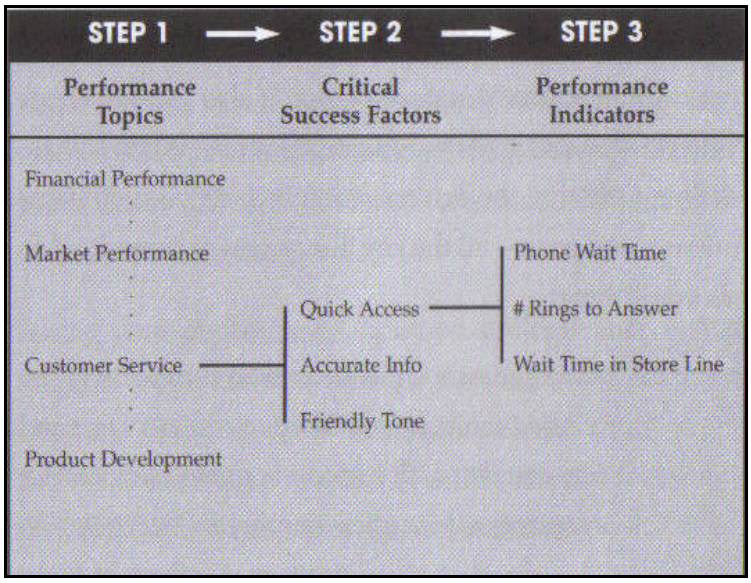


Figure D.3. Sample of Frost's 3-Step Process for Developing Meaningful Performance Indicators (Frost, B., 2000)

EBASS has the potential of distilling large quantities of data and information into actionable intelligence. In doing so, EBASS empowers commanders with the power to choose appropriate courses of action that advance both military and policy objectives. A sample three-step metrics development chart for a military operation is shown below in Table D.1:

Table D.1. A Sample 3-Step Metrics Development Chart for a Military Operation

Performance Topics	Critical Success Factors	Suggested Performance Metrics (leading)	Old Performance Metrics (lagging)
Regional Stability	Ability of governing powers within a region to self-regulate	Capabilities of coalition forces within a region + capabilities of local forces (an examination of unit METLs); amount of coalition forces and types of forces needed in area of operations	Troop strength and amount of key equipment in a particular region
	The functioning of key governing responsibilities—health, water, food supplies, power generation, etc.	A multi-dimensional assessment of key governing responsibilities	Regional request for military assistance or support
	Neighboring governments able to work with one another	A multi-dimensional assessment of key regional antagonisms and mutual support structures	Potential and actual regional conflicts and disputes
Safety of Forces	Providing conditions that enable coalition forces to operate under better managed risk conditions	A multi-dimensional assessment of area of operations based on key activities, historical events, public sentiment, locality, etc.	# of hostile actions/period
		Capabilities of coalition forces aligned with duties and responsiblities (METL assessment)	# of accidents/period # of fatalities/period

D.5. Conclusions: EBASS as a Viable Strategy-Based Performance Management System

To improve, according to one Webster's definition, means to "enhance in value or quality." This definition implies that value and quality are already present in existing methods to measure progress and success. EBASS aims to improve upon the merits of current military operational assessment methodologies. Today's enabling technologies permit EBASS to leverage the large amounts of information within an area of interest and distill it into a comprehensible intelligence that is timely, reliable, and accurate. Because EBASS takes a more objective approach to characterizing and encapsulating vast amounts of data, it follows that EBASS should be an ideal strategy-based performance management system that analytically targets continual

improvement (Figure D.4). However, success for EBASS depends largely on the performance measures chosen to gauge the success of military actions and operations.

Figure D.4. Strategy-Based Performance Management Design (Frost, B., 2000)

Perhaps more importantly, continual improvement within EBASS itself depends largely on the development and selection of performance indicators that are SMART—specific, measurable, aligned to key objectives, realistic, and time-bound.

Jim O'Brien, University of Kentucky Associate Basketball Coach, once remarked, "Excellence is the unlimited ability to improve the quality of what you have to offer." EBASS has the potential to enhance the way the military assesses operational success. With the appropriate metrics, EBASS has the potential to facilitate real-time communications that is required of highly effective and efficient organizations (Figure D.5). With the right metrics,

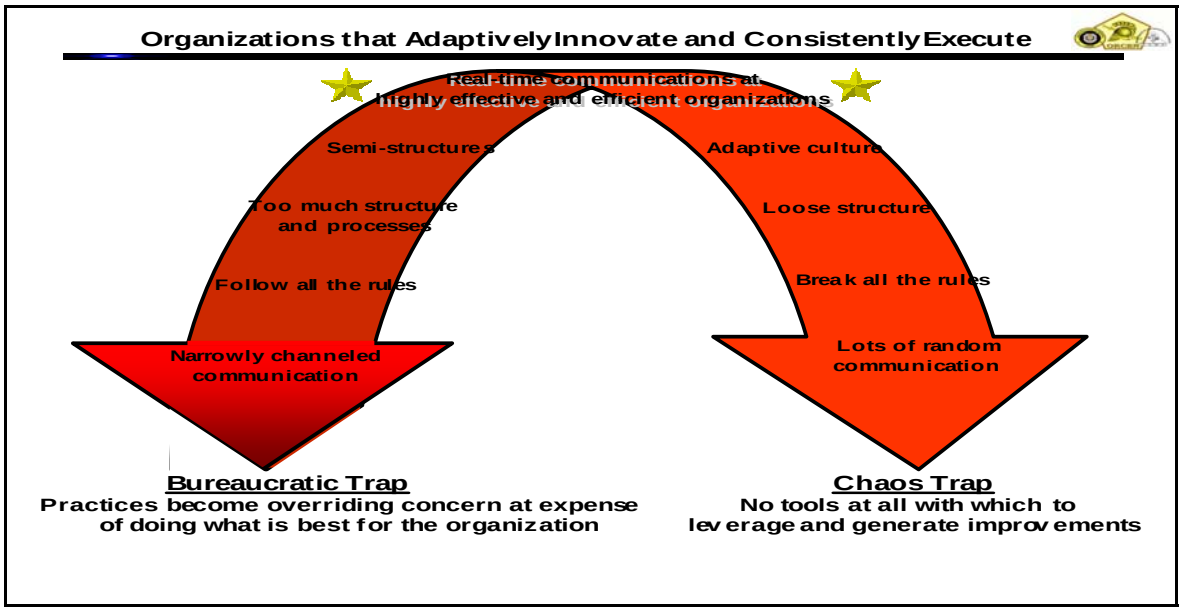


Figure D.5. Avoiding Both the Bureaucratic and Chaos Trap (Brown, S., and Eisenhardt, K., 1998)

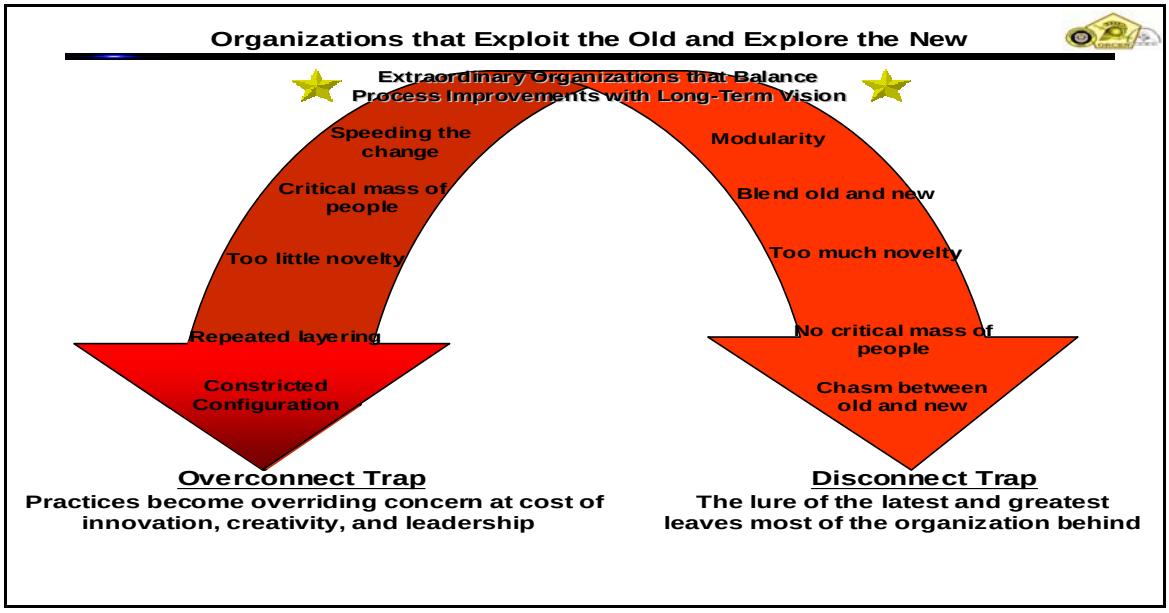


Figure D.6. Avoiding Both the Overconnect and Disconnect Trap (Brown, S., and Eisenhardt, K., 1998)

EBASS has the opportunity to align process improvement with long-term vision in order to make our military a much more effective instrument for policy implementation (Figure D.6). Ideal for this new century, EBASS is a strategy-based performance management system that aims to achieve operational excellence.

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14. ABSTRACT

The Effects Based Assessment Support System (EBASS) is a distributed operational assessment tool based on the principles of Value Focused Thinking (VFT) developed jointly by the Operations Research Center of Excellence (ORCEN) and the Information Technology and Operations Center (ITOC) at the US Military Academy. Its genesis is work done in support of the military command in Afghanistan in 2002. Effects based assessment is utilized to determine the progress of organization to influence behaviors or the environment to achieve a specific end state. In order to facilitate this, decision makers need a data collection and information visualization tool flexible enough to utilize measures most appropriate for the domain, which 1) provides a qualitative value model which can account for the decision makers' most important evaluation considerations & measures, and 2) provides quantitative scoring functions and weights to evaluate alternatives.

15. SUBJECT TERMS

Effects Based Assessment, Value Focused Thinking, Web Based Assessment

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